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The Psychology of Learning

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Library
Calcutta
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Foreword

In recent years teaching has taken on a new concern for its importance and effectiveness. Leaders of public opinion and the teaching profession as well as research scholars are refocusing their concerns and renewing inquiry into the phenomena of learning and the problems of teaching.

Dr. Ralph Garry has written *The Psychology of Learning* as an appropriate response to the need for the re-examination of education. The content of the monograph draws upon research in the behavioral sciences, particularly psychology, to state findings and to test concepts. Conceptual systems are described to give insight into learning. The salient feature of the monograph is that research and theory are integrated with practice. The teacher, school administrator, and scholar will find an honest confrontation of facts and ideas with the practical problems of application.

A brief study of the chapter headings—*e.g.*, the learner, learning task, teaching procedures—will invite the student of learning to explore further. A balanced treatment regarding the controversial teaching machine is suggested by the elements of the final chapter—"The Teacher, Teaching Machines, and Transfer," and the class as a socio-psychological unit. Thus the monograph comes full circle to highlight again the social and psychological conditions of learning. Establishing these conditions is a primary task of the teacher.

For several reasons the monograph could be recommended. The reader is likely to find a most suggestive and attractive reason in that it may help him to clarify and to modify constructively his private theories of the psychology of learning.

In the final analysis the teacher's practice is based upon his theories and his understandings of facts—his personal formulations. To re-examine them through a reading of *The Psychology of Learning* is a high order of professional experience. This is sufficient reason for recommending the monograph.

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The Psychology of Learning

CHAPTER I

Introduction

The news of the week provides graphic testimony to the range of man's activities—a discovery of the process of electrochemical change regulating thought is reported; an athlete establishes a new world's high jump record; a political leader is murdered; a space probe to an adjacent planet is launched; a conference on nuclear disarmament is under way; a trusted bank employee is discovered to have embezzled a fortune. Although we read of the events with interest, we rarely pause to reflect on the range of human behavior portrayed in any day's news, any more than we reflect on the range of skill involved in our individual actions during the day. Housekeeping, perhaps the most mundane of occupations, requires extensive skill—food preparation, operation of mechanical equipment, purchasing, child care, sewing, and so on. The development of those skills depends upon extended training involving motor skill, memory, computation, comprehension, problem solving, and many other aspects of learning. Few give the process of acquiring and retaining these skills much thought, for learning is a process that goes on with little or no awareness. We are aware of progress in learning, of stages or levels reached, of having mastered a task, but hardly of what occurred to produce the accomplishment. Having learned, we accept its manifestations as a matter of fact in much the same way we take the variety of events in the newspaper for granted.

Each of the events selected demonstrates the ubiquity of learning. The biochemist studying electrochemical changes in the brain had to develop and control exquisitely delicate techniques of exploration and measurement as well as conceive a procedure for catching thought in flight, namely spinning animals in a centrifuge knowing it would yield a predetermined cerebral change. The high jumper not only needed a physical structure suited to the task, but years of training to develop the motor control and coordination that catapulted his body to new height. The murder and the embezzlement, unfortunate activities though they are, nonetheless required knowledge and skill. The murder required planning, systematic preparation and execution, and coordinated group action; the embezzlement, a solitary performance, demanded sustained careful management of bookkeeping procedures over several years. The space probe required the combined talents and training of a diversified corps of scientists and engineers, each of whom underwent long and arduous training, backed by the maximum in technology that our society can muster. These events alone are sufficient to justify designating man the learner.

For a thousand centuries, man has changed little, his behavior much. Where other species survive by engendering new species through selection and mutation, man has survived by modifying his behavior. There is a vastly greater difference between the behavior of the Eskimo living on the arctic icecap and the Lacadone Indian living in the tropical rain-forest than there is between the Arctic hare and the jackrabbit, or between other members of a given genus. Though brothers under the skin, the tools, techniques, and behavior of the two men are completely different. Such modifications occur primarily through learning, the process by which behavior is initiated or changed as a result of experience or, more specifically, through training and practice. Certain contrasts can give the definition some significance.

Learning and Maturation

At first consideration, there would appear to be no human behavior which escapes the influence and effects of learning. This is largely true, for even physiological processes can be shown to be affected, function and event being interlocked. But many changes occur or are made possible as a result of physiological maturation. No amount of training will induce a mastery of walking in a child of six months or of algebra in one of six years because the capacity to acquire those skills is simply lacking at those ages. Many changes are dependent upon the presence of appropriate neuromuscular development. The most easily observable skills are in the motor area —those requiring hand-eye coordination, such as catching a ball, body control as in diving, or strength—but many aspects of intellectual development are dependent upon maturation such as concepts of time and space.

Learning and Performance

Learning and performance are intricately interlocked. The former is the process by which behavior is changed; the latter, the gauge of results. The one cannot be taken for the other. Learning produces changes in performance. At the simplest level, this may consist of developing a new response to a stimulus or shifting an existing response to a new stimulus. The change in performance may be at the symbolic level, occurring vicariously, as in language learning. Learning is not the only process that mediates change in performance. Forgetting produces changes whereby performance is impaired; fatigue interferes with the proficiency of performance; maturation and motivation affect performance. Changes in performance are dependent on short term processes, such as fatigue and motivation, and long term processes, such as maturation and forgetting, as well as on learning. Performance is thus an imperfect measure of learning. Usually we attempt to manipulate performance in some tangible manner, particularly in school situations, to produce specific changes. But several aspects of learning are not easily managed. Attitudes, ideals, fears, and symbolic learning are quite intangible, both in acquisition and manifestation, making it difficult to bring the learning process under control, whether by use of performance to influence the process of change, or as a measure of amount of change.

In spite of our most carefully arranged efforts, the results of learning are not always for the better. There is no guarantee of improved performance. A case in point is the painful experience of a young woman who recently set about learning to ski. Inexperienced but highly motivated to learn, she made rapid progress under daily professional instruction. One afternoon a well-meaning friend proceeded to "help" her, teaching her an outmoded style entirely different from that of the professional instructor. Willing to accept help from anyone having experience, the young woman faithfully attempted to carry out the friend's instructions, but found her control steadily deteriorating. The harder she worked, the more she fell.

Finally she fell and sprained an ankle. When she returned to skis a week later, three successive professional training sessions were required to eliminate the faults she had acquired during the friend's brief session. In this instance the loss in performance resulted from incompatible techniques. But whatever the explanation, there is no certainty that errors will not be learned faster than correct responses. Hopefully, learning will make a person more competent, more able to adapt successfully to and live in harmony with his environment. However, this is more a promise to be aspired to than an event to be assumed, if the number of maladjusted individuals around us is any measure of the situation.

Learning and Society

In these first paragraphs we have looked at learning from the viewpoint of the individual and in an isolated sense. Each of us is born with certain basic drives which have to be satisfied if we are to survive, and each of us is born with a biologically transmitted capacity to learn. At birth, if not earlier, we commence striving to satisfy our basic needs, beginning the lifelong process of learning how to use our capacities to satisfy these drives. Satisfaction must be sought in a social context. From birth to death we are dependent on other persons for satisfaction of even the most basic of needs. Looking at the complex of human behavior, simple-need satisfaction requires but a fraction of human energy. A much greater share goes for the satisfaction of elaborate goals and the fulfillment of social functions. Here, the primary determinant of behavior is not the individual but the society and culture of which he is a member.

Beginning in the family, the child learns the ways of the group, the routines, habits, customs, etiquette, and so forth that characterize it. As he expands his range of contact in play groups, in school, and at work he learns more ways of the group and the society in which he is a member. Much of his energy is spent learning skills and habits that do not come naturally: buttons, toothbrushes, tools, language, forms of address and deference, morality, machine operation, tax-paying, whatnot. In short, he learns the technical skills and the rules of the game which he must know if he is to be able to satisfy his wants and fulfill his function in the society. If he is successful, he can be reasonably sure of sustenance and protection from the society. He will obtain a position in the social order and have certain status. If he fails, he will be termed maladjusted; if his deviation from the accepted order is excessive, he will be segregated in an institution. He will learn what to want, how to behave, and the means by which to satisfy his want. If he is adaptable, he will learn how to learn, how to change his behavior in the face of new circumstances in which old patterns fail. Learning serves two purposes: acquisition of the behavioral patterns that the society prescribes, and acquisition of a technique for changing behavior. For the first purpose, learning is tantamount to standardization of behavior, a reduction in variability of action; for the second, learning provides for changeability of behavior, the ability to adapt to novel situations.

Learning and School

When a group of parents is asked to identify the objectives of schooling—what a child should have accomplished by the time he leaves school—it will produce a varied list likely to include ability to communicate effectively, to get along with others, and to think and solve problems; a knowledge of the fundamentals; acquisition of a zest for learning and a philosophy of life; ability to earn a living and to behave in an ethical and moral way; acquisition of a hobby; ability to participate in various sports; how to be a good citizen interested in the community and the world; self-confidence; and other worthy objectives.

Ignoring, for the moment, the difficulty inherent in the foregoing list in either establishing a priority as to order of importance or determining what level of achievement in each is to be expected, one observes the ends established by our society for its members. These ends may be classified in a number of useful ways.

Cultural	Involves
Communicate effectively Read, write, speak Knowledge of environment Participate in sports Have a philosophy	learning to function not only in the physical environment but especially in the manmade part of the environment through knowledge of the language, numbers, technology, customs, and traditions.

Social	
Get along with others Be a good citizen Act morally Be interested in community and world	knowing how the society functions on the large scale—economics, governments, politics, religion, etc., and also on the informal, face-to-face level.
Personal	
Think and solve problems Have zest for learning Earn a living Self-confidence	knowledge of oneself, one's abilities, where they fit into the society, how to satisfy one's needs within the socially established framework.

Every list of educational objectives formulated by educators in the past half-century incorporates the items just listed. The National Education Association's list that follows was prepared in 1912; that of the Progressive Education Association, in 1938.

NEA

1. Health
2. Command of fundamental processes
3. Worthy home membership
4. Vocation
5. Citizenship
6. Worthy use of leisure
7. Ethical character

PEA

1. Physical and mental health
2. Self-assurance
3. Assurance of growth toward adult status
4. Philosophy of life
5. Wide range of personal interests
6. Aesthetic appreciations
7. Intelligent self-direction
8. Progress toward maturity in social relations with age mates and adults
9. Wise use of goods and services
10. Vocational orientation
11. Vocational competence

Converting social objectives into more explicit educational objectives, they are more often expressed as the acquisition of:

Skills
Knowledge

with respect to

Language arts
Mathematics
Biological science
Physical science
Social science

Attitudes	Fine arts
	Vocational skill
Behavior	Physical education
	Other subjects

This type of classification is particularly useful in an educational framework to identify the specific outcomes desired at a given grade level in a particular subject, and assists in the development of curricula which have some unity. For purposes of the study of learning, we are less concerned with *what* is learned than with *how* it is learned, for our objective is to understand the learning process and how to increase the proficiency with which we manage it. For this purpose, a subject matter organization is less helpful than a scheme which looks at human behavior with respect to certain functional differences in the kind of learning which is occurring. For example, language arts, fine arts, vocational training, and physical education all require the development of motor skill, but the principles of learning which apply to motor skill are likely to apply irrespective of the educational subject matter. Several classification schemes for grouping learning outcomes in psychologically meaningful fashion are possible, but one which closely parallels the educational rubrics of skill, knowledge, attitude, and behavior is to classify learning outcomes as *motor, verbal, cognitive,* and *attitudinal.*

Having identified learning as a process through which certain behavioral changes are brought about, we are concerned with identifying the factors and conditions which affect the learning process. In school situations, three primary sets of variables enter into the equation: the learner, the task to be mastered, and the teacher. Learners vary in their capacity, readiness, and previous experience; tasks vary in difficulty and complexity; teachers vary in the kinds of incentives they provide and the amount of practice and drill they employ. Each of these variables must be studied and understood. For each, singly or together, effects the learning process. When we speak of "affecting the learning process" we are considering, not only the acquisition of skill or knowledge, but also retention and utilization. A diagrammatic presentation of the factors we have been considering is shown in the following figure.

Learning is not going to occur without learner or task, but it can

VARIABLES INFLUENCING	PROCESS	PRODUCT	
Individual Age Sex Capacity Readiness Previous experience Motivation	*Maturation* Changes in performance resulting from physiological growth and development	*Cultural*	*Perceptual-Motor skills* *Verbal informational learning*
Task Organization Difficulty Meaningfulness Length Emotional affect	*Learning* Changes in performance resulting from training and practice	*Social*	*Cognitive learning* Comprehension Thinking Problem-solving
Teacher Practice Guidance Incentives Knowledge of Results Drill	Acquisition Retention Utilization and Transfer	*Personal*	*Attitudinal Learning* Attitudes Emotions Ideals

occur without a teacher. Many of our most important learnings —personal, emotional, and attitudinal—are learned informally through contacts with family and friends. Sometimes it appears that the main function of teachers, at least as far as factual learning is concerned, is to tell us where to look and to provide us a schedule for looking. Certainly the major portion of any college education could be acquired by a highly motivated and well-disciplined learner. But with or without a teacher, practice, knowledge of results, and drill are still needed. Our task in this book, then, is to impart some understanding of how the variables listed singly and collectively effect the learning process, for in any learning situation, many if not all of these factors are operative and interacting with one another. We need to understand the generalizations that can be made about the relationships, and we need to organize them into some kind of conceptual whole, a theoretical explanation of the learning process. Perhaps more to the point, we as teachers need to check the private theories about how learning progresses implicit in our beliefs in order to determine how sound our pedagogical practices are.

Private theories abound, however vaguely defined they may be, because of the gap between the laboratory and the classroom. An extensive body of knowledge has accumulated from experiments on animal and human learning in laboratory situations, but this knowledge has had limited impact on teaching methodology and classroom practice. In part this results from the empirical nature of educational practice whereby the lore of teaching is transmitted from teacher to teacher, in part because of the distances between the learning theorist and the educational practitioner, the psychologist and the teacher.

Two main streams of theory affecting research on learning have been association theory and field theory; in current usage, behavior theory and cognitive theory. In the former, learning is thought of as the linking of stimuli with responses to form habits; in the latter, as acquiring understanding of the relationship in a field to form cognitive structures. Reinforcement plays a prominent role in association theory; insight, in cognitive theory. A decade ago variations in theory were identified by the names of major contributors—Thorndike, Guthrie, Skinner, and Hull in the association theory group; Lewin and Tolman in the field theory group. More recently as research has accumulated, it has become clear that theoretical issues are not going to be resolved in favor of one position or another, but that more sophisticated explanations are required. The student wishing to explore theoretical and research issues in learning will find excellent statements of the several positions in Koch [1], Hilgard [2] and Estes,[3] and resumes of the theoretical issues in the *Annual Review of Psychology*.[4]

Although the results of laboratory research cannot be directly translated into classroom practice, a number of principles have been established which have direct and practical implications. Hilgard [5] has summarized them and added a number from personality theory:

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[1] S. Koch, *Psychology; A Study of Science*, Vol. 2 (New York: McGraw-Hill Book Company, 1959).

[2] E. R. Hilgard, *Theories of Learning*, rev. ed. (New York: Appleton-Century-Crofts, 1956).

[3] W. K. Estes, *et al.*, *Modern Learning Theory* (New York: Appleton-Century-Crofts, 1954).

[4] *Annual Review of Psychology* (Stanford, Cal.: Annual Reviews, Inc., 1950–62).

[5] E. R. Hilgard, "Learning theory and its applications," in Schramm, W., *New Teaching Aids for the American Classroom* (Stanford, Calif.: Institute for Communication Research, 1960).

Principles emphasized within stimulus-response theory

1. The learner should be *active,* rather than a passive listener or viewer. The S-R theory emphasizes the significance of the learner's *responses,* and "learning by doing" is still an acceptable slogan.

2. *Frequency* of repetition is still important in acquiring skill, and in bringing enough overlearning to guarantee retention. One does not learn to type, or play the piano, or to speak a foreign language, without some repetitive practice.

3. *Reinforcement* is important; that is, repetition should be under arrangements in which correct responses are rewarded. While there are some lingering questions over details, it is generally found that positive reinforcements (rewards) are to be preferred to negative reinforcements (punishments).

4. Generalization and discrimination suggest the importance of practice in varied contexts, so that learning will become (or remain) appropriate to a wider (or more restricted) range of stimuli.

5. *Conflicts* attendant upon generalization and discrimination have consequences that may be unintended by the person attempting to manage the learning. Many of these consequences, as studied by Neal Miller, are the kind that interest students of psychopathology.

6. *Drive* conditions are important to learning, but all personal-social motives do not conform to the drive interpretations of Hull and Spence. Anxiety, as measured by the Taylor scale, appears to act as a drive should, but achievement motivation apparently does not (Farber 1955).

Principles emphasized within cognitive theory

1. A learning problem should be so structured and presented that the essential relationships are open to the inspection of the learner. The *perceptual aspects* of the problem (figure-ground relations, directional signs, "what-leads-to-what") represents important features.

2. The direction from simple to complex is *not* from arbitrary, meaningless parts to meaningful wholes, but instead from *simplified* wholes to *more complex* wholes. This suggests that we need to study the psychological organization of knowledge, and should not deal mechanically with the part-whole problem.

3. Learning with *understanding* is more permanent and more transferable than rote learning or learning by formula. This generalization gives point to the similar emphasis within S-R on meaningfulness as a factor making for ease of acquisition and recall.

4. *Cognitive feedback* establishes probabilities and (in some

cases, at least) is in appropriate explanation of effective reinforcement. The corresponding S-R principle is that of knowledge of results. The notion is that the learner tries something provisionally, and confirms his attempt by its consequences.

5. *Goal setting* by the learner is important as motivation for learning, and his successes and failures are determiners of how he sets his future goals. The attempt to reduce cognitive dissonance (Festinger 1957) leads to many kinds of maneuvers *after* the results are in.

It will be noted that this list from the cognitive position is somewhat harder to specify than from S-R theory, and the points, while plausible, lack systematic proof . . . this lack of working out of cognitive learning theory does not mean that the theory has nothing to offer.

Principles from personality theory

. . . the following principles, little emphasized within the psychology of learning, are important background factors for school learning.

1. The learner's *abilities* are important, and provisions have to be made for the slower and more rapid learners.

2. Some abilities are a matter of physiological and social *development* and knowledge of development should be related to the demands made on the learner. Some such knowledge may turn out to be very important, *e.g.* in the teaching of reading and spelling.

3. Personality is a *social product*. Hence it is important to be aware of the culture and subculture as they are relevant to what and how the learner can learn.

4. *Anxiety level,* especially the "test anxiety" of Mandler and Sarason (1952), appears important in determining the beneficial (or detrimental) influence of praise and blame. The generalization appears justified that with some kinds of tasks high-anxious learners perform better if *not* reminded as to how well (or poorly) they are doing, while low-anxious learners do better if they *are* interrupted with comments on their progress.

5. The same objective situation may tap *appropriate motives* of one learner and not of another. The contrast, for example, between those high in achievement motivation and those high in affiliation motivation has been reported by Elizabeth G. French (1958).

6. The *organization* of motives and values in the individual is relevant. Some long-range goals affect short-range activities. For example, college students of equal ability do better in courses perceived as relative to their majors than those perceived as irrelevant.

7. The *group atmosphere* of learning (competition vs. cooperation, authoritarianism vs. democracy, individual isolation vs. group identification) will affect satisfaction in learning as well as the products of learning.

CHAPTER II

The Learner

In our efforts to provide universal education the standard administrative arrangement has been to group children in classes of 25–30 pupils. This arrangement creates the most difficult task that teachers have to face—providing for the individual differences found within such a group. The differences between and within the children are often ignored. When not ignored, they are more often only recognized than provided for. When they are provided for, the commonest procedure is acceptance of difference rates of progress through the same series of tasks, rather than any provision of different materials and different procedures for mastering a given series of learning tasks.

Individual Differences

Consider some of the individual differences which a fifth grade teacher confronts:

Physical

Age
Height
Weight
Sex
Vision
Hearing
Motor ability
Handicaps

Personality

Character traits
Motivational needs
Interests
Attitudes
Affective reactions

Social

Socioeconomic status
Religious background
Ethnic background
Family relationships
Peer group relationships

Capacity

Intelligence
Aptitudes
  Language
  Mathematics
  Science
  Art
  Music

Achievement

- School achievement
  - Reading
  - Arithmetic
  - Science
  - Art
  - Music
  - Social studies
- Out-of-school
  - Hobbies
  - Art
  - Music
  - Sport

The list is not exhaustive; it merely identifies the major kinds of difference. Few of the items could be eliminated from the list as not influencing learning. However, primary and secondary significance could be assigned. The range of differences within a typical fifth grade is great. Depending upon the promotional policy of the school (social promotion maintains a narrower age range per grade), the variation in age from youngest to oldest is certain to be 12 months, more likely to be 15–18 months, and may span 24–36 months. The tallest person in the class may be 12 inches taller than the shortest; a weight range of 60 pounds, the heaviest child weighing twice as much as the lightest, is common. The children will vary from those who can barely catch a ball to those who are Little League junior professionals. There is likely to be a child with minimal vision or hearing. Other children may have physical handicaps that impair movement and participation, if not their learning.

Within such a class, scores on an intelligence test will range from approximately 70 to 140 as they will in typical heterogeneously grouped classes. A more meaningful grasp of the significance of this range in intelligence quotients is obtained by converting the scores to mental ages. An intelligence quotient is a ratio of mental age to chronological age. Mental age is a term which describes the age level of a selected group of test items which an individual is capable of performing. If a child at the age of ten is capable of performing the test tasks assigned to the 10 year level, his mental age is equivalent to his chronological age with the result that he has an average intelligence quotient.

$$\frac{\text{Mental age}}{\text{Chronological age}} = \text{IQ} \qquad \frac{10}{10} = 1.00\ (100) = 100$$

As a convenience, the fraction is multiplied by 100 to obtain a whole number quotient. If a child at age 10 obtains a mental age of

7, his IQ is 70. His mental growth is progressing more slowly than that of the average child.

$$\frac{(MA)\ \ 7}{(CA)\ 10} \times 100 = 70\ (IQ)$$

Similarly, in order for a ten-year-old to obtain an IQ of 140, his tested mental age would have to be 14.0.

Within the class we are discussing, the range in mental ages is 7–14. If a younger group were considered, the same IQ's would yield a smaller range in mental ages; *e.g.*, at age 5 the MA range would be 3.5 to 7.0. The range in intellectual capacity within a fifth grade class frequently covers a seven-year age range and gives one index of the spread of individual differences to be faced by the classroom teacher. The varied aptitudes, listed and unlisted, will cover a comparable range.

Looking at the range in achievements occuring within such a group, the reading achievement may be expected to range from second to ninth or tenth grade level. Five out of six children will fall within a fourth to sixth grade level in a typical class. The range in arithmetic achievement will be somewhat smaller because of instructional procedures which provide drill for slower learners, and because, unlike reading, few of the abler children engage in activity involving arithmetic learning outside of class. Thus, although the range of learning will vary from subject to subject, it will be considerable. Some of the differences in achievement are mainly the result of the school, others such as art and music are more likely to occur from outside instruction. Some will result from hobby activity. But whatever the skill, the range in achievement will be great.

Motives, interests, attitudes, and character traits, although not as accurately described will reveal considerable differences, and the differences will have significance for children's learnings. The social differences, family backgrounds, and other associated factors will be diverse; however, they may be only indirectly related to the child's learning, inasmuch as the motivational patterns, attitudes, and the like which result from these out-of-school relationships will reflect the social differences.

Not only are there differences between children but also within children. Consider your own aptitudes and abilities for a moment.

Undoubtedly you have special talents as well as areas in which your aptitudes are limited. As a result of learning, you have gained extensive knowledge and skill in some areas if little in others. Such high-low patterning of abilities is characteristic of most people. It is a rare person who is equally proficient in all areas.

Intelligence tests are widely used to estimate a child's potential for learning. When one stops to consider the high-low patterning of abilities, variations which occur within every individual, a failing of intelligence tests is apparent. It is not an equally good predictor of all aspects of performance. Intelligence tests are better thought of as scholastic aptitude tests, for they are reasonably good predictors of learning in school situations in which there is a high dependence on verbal skills. In many phases of human activity we lack adequate measurement criteria; *e.g.*, art aptitude, musical aptitude, creativity, leadership, science aptitude, and others. In those areas teachers have to look for other indicators as evidence of capacity, not the least of which is actual rate of progress in the task itself.

Begin where the learner is. Whether one is dealing with a single child or a group of children, assessment of standings at the time of initial contact is essential. Such assessment involves appraisal of a child's level of performance and capacity for development in relation to the learning tasks to be presented and the mode by which they are to be presented. Achievement tests given at the beginning of a school year indicate probable level of performance. Review tests or quizzes covering selected aspects of the previous year's work yield appraisals of strengths and weaknesses. Observation of rate of learning of new material during early phases of the school year, or during the introduction of any new learning situation, can provide valuable clues, not only of rate of learning, but also of such important characteristics as work habits, mode of attack, confidence, response to failure, and initiative. Such assessment is never completed or wholly accurate, for it is a continuous process carried on as much by observation as measurement. It requires consideration of the two major processes affecting development: maturation and learning.

Maturation

We use the term "maturation" in sundry ways. The child who is impulsive, easily upset, or unusually fearful is termed "emotionally immature." The self-centered child, the uncooperative child, and the docile child are thought "socially immature." Maturity is seen as comprising given levels of performance in physical, sexual, emotional, and social areas. Lists of the characteristics of maturity and immaturity vary, but when we speak of maturity or immaturity of adults we include such items as the following:

IMMATURE	MATURE
Irresponsible, compulsive, anxious	Responsible
Undefined goals; aimless, seeking immediate gratification	Goal-directed behavior; able to work toward deferred goals
Defensive, antagonistic, fearful of opposite sex	Mutually satisfying heterosexual relations
Interpersonal relations marked by stress, conflict, tension, competition, dominance-submission	Interpersonal relations marked by mutual regard, cooperation, sharing
Self-denying or self-indulgent of physical needs	Gratification of physical needs without overindulgence
Egocentric; sado-masochistic	Able to care for another
Meets frustration via escape, compensation, displacement	Faces frustration via direct or compromise action
Overconcentration of energies in any area	Balance in living—work, play, love, rest
Marked feeling of guilt or hostility	Freedom from guilt, hostility
Rabidly reformist	Constructive effort for general good; social responsibility

The *state* of maturity is to be distinguished from the *process* of maturing. The latter refers to the process of physical growth and development through which physiological and neuromuscular changes occur which in turn make certain kinds of learning possible. The changes occurring during childhood follow a characteristic sequence.

By age 2, the rapid rate of growth observed during the pre- and post-natal periods slows to a steady uniform pace of approximately five per cent per year for height and ten per cent for weight. Between ages 6–12 physical skill, strength, and endurance show marked gains. Coordination improves, speed of reaction accelerates, energy output advances. During the 10–13 year period a growth spurt occurs which precedes the rapid growth of adolescence as sexual maturity is reached. At this time girls are approximately two years ahead of boys in reaching physical maturation; height and weight gains are greater than in boys. This period of rapid growth is accompanied by pronounced physical changes in all body systems and is marked by *asynochronism* and *asymmetry; i.e.,* the various systems are out of step and balance with each other. Head size and shape, body structure, the ratio of tissue to skeleton, heart size, blood pressure and pulse, and glandular secretions are all undergoing marked changes at varying rates.

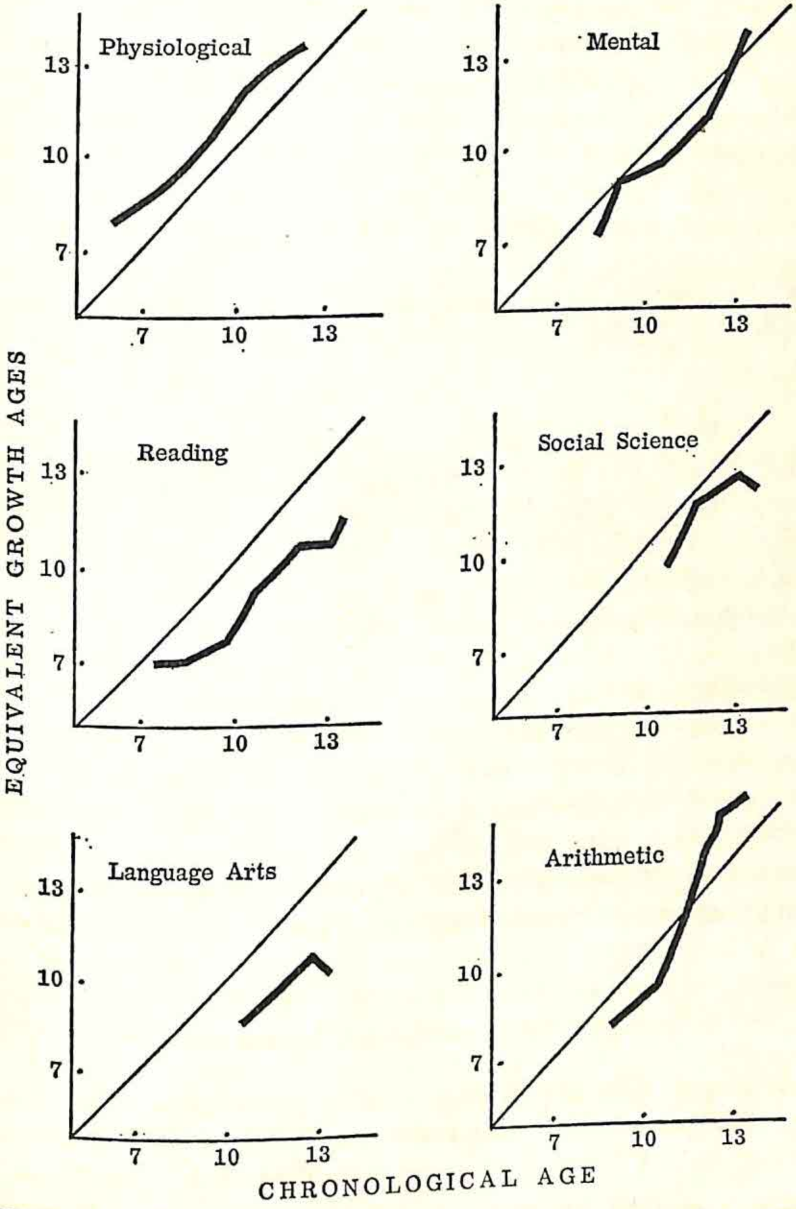
Not only are physical changes occurring, but also changes in intellectual capacities. Problem-solving ability involving the ability to generalize, abstract, and perform complex reasoning develops continuously, as does the ability to comprehend cause-effect relationships. Vocabulary shows marked gains with an estimated acquisition in recognition in excess of 10,000 words during the elementary school period.

Although the sequence of development is consistent when data from groups are averaged, individual children show marked variation.

Age, Maturation, and Readiness

Inspection of the graphs indicates that at any of the ages shown, this child reveals considerable difference in level of performance in each of the different areas. Even wider variation is observed in comparisons of children of the same age. Generally, the performance of older children is superior to that of younger children on both

The graphs bellow illustrate the variation in growth curves of an individual child.[1] Uniform growth in each area commensurate with age is shown by the diagonal.



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[1] Source: C. V. Millard and J. W. M. Rothney, *The Elementary School Child* (New York: The Dryden Press, 1957).

motor and intellectual tasks, but age of itself is not particularly helpful in predicting individual performance. Differences in performance are more likely to be associated with experiences than with age. Older children can follow verbal directions better, work for longer periods of time with greater endurance, and direct energy and attention more effectively than younger children, who tire more rapidly, are discouraged more readily, lack many essential work skills, and have less ability to generalize and synthesize isolated experiences. The differences are even more marked when one compares children from markedly different environment; *e.g.*, upper vs. lower class or farm vs. urban.

In actual practice, it is difficult to isolate maturation from previous experience. The interplay of the two elements is evident in the varied uses we make of the term "maturation," so many of which incorporate the experience factor in describing various levels of maturity. Where novel tasks can be developed for learning experiments, a distinction can be drawn. For instance, in the learning of motor skills, the differences that occur between younger and older children are the result of higher starting scores rather than differences in rate of learning. In the experimental evidence adduced by Munn [2] there is nothing to indicate that older children improve more rapidly than younger when the amount of practice is held constant. When McGinnis [3] gave groups of 3-, 4-, and 5-year-old children the same number of trials on learning a maze (a task of which no prior experience existed), the older children were superior at both beginning and end, but the gains made by the three groups were equivalent. When very young children are compared with older children on tasks within their capacity, the differences in learning rate result from differences in strength, experience, and motivation rather than age. In comparisons of the relationship of age, height, weight, and skeletal maturity to the skill of performance of such tasks as running, jumping, and throwing, only skeletal maturity showed a significant relationship.[4]

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[2] N. L. Munn, "Learning in children," in *Manual of Child Psychology*, L. Carmichael, ed. (New York: John Wiley & Sons, 1954), pp. 374-458.

[3] E. McGinnis, "The Acquisition and Interference of Motor Habits in Young Children," *Journal of Experimental Psychology*, 32 (1943), pp. 1-16.

[4] L. Seels, "The Relationship Between Measures of Physical Growth and Gross Motor Performance," *Research Quarterly* (1951), pp. 244-50.

As motor learning tasks become more complex, they inevitably involve intellectual as well as motor abilities, which usually, although not necessarily, gives an advantage to older subjects. Their ability to remember instructions, work longer for delayed reward, and so forth, provide an advantage. An illustration of the complexity of the problem is shown in foreign-language learning in the elementary school. The imitative talents of younger children, lack of inhibition, and their freedom from interference of previous language learning gives them an advantage in pronunciation and oral expression of the language. They learn the meanings of the sounds in a separate context. The older the child, the greater the degree of association between native and foreign language. While this association may be of some advantage in structural analysis, it interferes with ability to acquire and maintain separate fluency.

Similar generalizations may be made with respect to maturation and verbal learning. Disregarding differences in experience, the advantages associated with age are a function of gains in mental rather than chronological age. These findings are even more pertinent when one considers that the typical classroom contains a restricted range in ages, indicating a need to look to other factors, such as maturation and previous experience, as important in contributing to individual differences in learning.

Readiness is the educational concept associated with maturation. Prior to introducing a learner to a task, a judgment has to be made as to whether or not he is ready to learn the task. The concept of readiness involves the two different meanings of maturation described earlier in this chapter. With young children, readiness involves the question of whether or not the child has matured physiologically to the point where he can undertake the task—is his neuromuscular and intellectual development sufficient? As the child grows older, the question becomes less one of whether or not he is physically ready and more one of whether or not he has had, in addition to the required aptitude, the experiences prerequisite to learning the task. In order to learn skills such as typing, shorthand, and algebra, one must have not only a sufficient degree of motor or intellectual ability but also skill in language and mathematics.

Important as the question of readiness is, there is only limited tangible evidence available upon which to base determination, espe-

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cially in complex tasks. For simple motor skills, training is likely to be of little value if a child lacks the minimal strength or motor control needed to perform the task, and may even contribute to the acquisition of faulty procedures that will subsequently interfere with learning. The same applies to certain cognitive tasks. Children taught number computation without sufficient opportunity to develop understanding of the meaning of numbers develop errors that subsequently hinder their work. The type of errors occurring most frequently on college entrance examinations in mathematics is application of incorrect formula for a solution of a problem, and inability to remember the complete formula. Lacking sufficient understanding of mathematics, students are unable to reconstruct a formula or analyze its suitability, probably as a result of overemphasis of the mechanical aspects of arithmetic and insufficient attention to conceptual development.

Generally, a determination of readiness is made by introducing a task, or a sample of it, and checking rate of learning during early practice sessions. A slow rate of gain and low degree of retention indicates either lack of readiness or excessively difficult materials, or both. Accelerated rate of gain and high degree of retention indicate material suitable to learning capacity.

Psychomotor capacities. Early work by McGraw[5] and Seashore,[6] among others, identified a number of fundamental capacities underlying the performance of motor skills. These were listed as:

Strength
Speed
Accuracy
Endurance
Agility
Body size
Reaction time
Steadiness
Balance
Control

In a comprehensive survey of research in this field, Guilford[7] reduced the number of factors to six:

Strength
Speed
Impulsion
Precision
Coordination
Flexibility

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[5] L. W. McGraw, "A Factory Analysis of Motor Learning," American Association of Health and Physical Education, *Research Quarterly,* 19 (1948), pp. 22-29.

[6] H. G. Seashore, "Some Relationships of Fine and Gross Motor Abilities," *Research Quarterly,* 13 (1942), pp. 259-74.

[7] J. P. Guilford, "A System of Psychomotor Abilities," *American Journal of Psychology,* 71 (1958), pp. 164-174.

The close similarity of the two lists is apparent, particularly when body size and endurance are subsumed under strength. Each of these factors may be considered not only in relation to over-all motor performance but also in relationship to body parts, such as trunk, arms, legs, hands, fingers. When consideration is given to the basic skills in physical education of running, jumping, vaulting, throwing, kicking, climbing, and catching, the significance of a difference in leg and arm strength can be seen for climbing versus vaulting.

Unlike intellectual abilities, where evidence can be marshaled for the existence of a general intelligence factor, studies indicate that motor learning is dependent upon specific abilities relative to specific motor skills. Seashore found the correlation between fine motor abilities to average .31, between gross motor abilities, .26, and close to zero correlation between the two sets, suggesting that in activities where intellectual ability is not an important factor, learning is a function of the specific musculature involved in the activity.

The more complex the motor skill, the greater the likelihood it will involve higher mental abilities; *i.e.*, learning will be correlated with intelligence. Some support for this is to be observed in the relationship between intelligence and occupation which shows that higher degrees of intelligence are associated with the more complex trade skills—electrician, tool and die maker, pattern maker, and the like. However, there are undoubtedly other social factors besides intelligence involved in the selection process, as is indicated by the variability within occupations and the overlap between occupational levels. We can now express a number of generalizations regarding maturation and motor capacity:

1. The capacity of an individual for learning motor skills depends upon both physical and mental capacities. Factor analysis has identified six basic elements (see p. 22)—involved in learning the fundamental physical skills of running, jumping, and so on, which in turn are components of complex sport skills.
2. The more complex the skill and the instructions involved, the greater influence of higher mental processes, and the greater the contribution of intelligence to speed of learning.
3. Degree of motor learning is dependent upon physiological maturation. With increasing age, social and psychological maturity become more important.

4. Within any age range, there is wide individual variation in motor achievement.

5. Strength is a primary determinant of degree of motor ability.

6. Strength and motor skill development tend to be congruent with the growth curve.

7. The capacity of boys and girls for motor learning compare favorably until adolescence, at which time boys tend to excel because of strength and physiological differences; *e.g.,* metabolism rates. Prior to puberty, differences in skill are a function of differences in experience.

Intellectual capacities. Most of the data available regarding intellectual differences are based upon the results of intelligence tests and, to a lesser degree, aptitude tests. It is unfortunate that the term "intelligence" is used in connection with tests which preferably should be termed scholastic aptitude tests. When one thinks of intelligence he ordinarily thinks of a capacity to function effectively in the environment, to be able to meet problem situations, to be able to adapt to new demands, and of similar global concepts. Intelligence tests tap a much narrower range of human capacity. They are not especially useful in predicting, say, leadership potential or salesmanship ability. The fact that the distribution of intelligence in prison populations is not very different from that in other populations suggests that intelligence tests are not tests of adaptability to life situations. These observations are not intended to diminish the value of such tests, but rather to improve judgment as to their meaning. It is commonplace for teachers to overestimate the significance of a given Intelligence Quotient. Children with high IQ's are expected to be competent at all tasks equally. A test score is automatically assumed to be reliable. If a child scores low, the fact that his academic performance is above average may be overlooked instead of being seen as a discrepancy which should lead to questioning of the test score. Many factors other than the true ability of a person combine to influence test scores:

1. The norms provided by the test author may be inadequate. A normative population overloaded with urban or rural samples would be inadequate for suburban populations.

2. The test may have been administered faultily. Time limits may not have been accurately observed, yielding higher or lower scores as the case may be. Cues as to correct response may have been sug-

gested on individual tests. The child may have misunderstood the directions, skipped a question, or recorded his answers in the wrong positions.

3. The child's motivation for taking the test may have been low. Two-thirds of children negativistic toward a test in one situation made gains when retested.

4. Children from different family backgrounds have wide variation in experience which influences their performance on intelligence tests. Intelligence tests depend on the assumption that all persons taking the test have had equivalent prior experience. This permits the conclusion that the differences in test performance are the result, not of common background of experience, but of differences in innate intelligence. This is obviously not the case, and Davis [8] has shown that children from different socioeconomic levels do not have equivalent opportunity. There is substantial evidence to show that children moving to more stimulating environmental circumstances show gains in test scores.

5. Tests differ in composition. Some are primarily vocabulary tests; others are recognition type using vocabulary, arithmetic, and spatial type items. Syllogisms, number series, and analogies are but a few of the many types of items which are found. In view of the data available from factor analyses of tests, it is known that kinds of items vary in the kind of human capacity which they tap. As a result, intra-individual variability in aptitude will produce variation in test scores consistent with the variation in kinds of items composing the test. In a similar manner, test scores obtained during childhood will vary considerably from infant test scores due to the great difference in test content as the tests shift from motor to verbal type items.

Apropos the conditions affecting test scores and interpretation of them by teachers, one teacher recently expressed great relief when she learned that the IQ's of her class were much lower according to the results of a second, different test than they had been on a test given six months earlier. The teacher complained that on the earlier test the children had scored in the high average to superior range of intelligence, and she had felt obliged to work extra hard in order to get them up to expectations. With the lower scores obtained on the second test, she felt that she could relax, because they confirmed her belief. Both interpretations failed to take into account the limitations of intelligence tests.

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[8] A. Davis, "Socio-economic Status and Its Influences on Children's Learning," in *Understanding the Child,* 20 (1951), pp. 10-16.

Diverse abilities are involved in the cognitive processes: perception, memory, symbolic reasoning, and problem solving. These involve such functions as discrimination, generalization, analysis, synthesis, imagination, creation. Intelligence tests, group or individual, even though composed of various types of items do not do equal justice to all the cognitive processes. Nonverbal tests place heavy dependence on graphic items requiring detection of missing parts, functional error, recognition of similarities and differences, digit-symbol substitution, and sequence arrangements. Verbal tests present vocabulary items calling for synonyms or antonyms, analogies, problem solving, computation, and the like. Inasmuch as differing human capacities are being utilized, scores will vary from test to test.

Through the factor analysis of tests—a mathematical procedure for identifying the unitary components within a battery of tests—a number of primary mental abilities have been identified along with the type of task requiring a particular kind of primary mental ability. By developing tests which are homogeneous in point of item type, separate measures of the individual abilities can be obtained. Much of the pioneer work in this field was carried out by L. L. Thurstone[9] at the University of Chicago during the development of the Chicago Primary Mental Abilities Tests. Table 2.1 reports the intercorrelations between five abilities.

TABLE 2.1

CORRELATIONS BETWEEN PRIMARY MENTAL ABILITIES (AGE 7–11)

	Vrb	*Spa*	*Rsn*	*Prcp*	*Num*
Verbal		.24	.63	.33	.25
Spatial			.40	.37	.10
Reasoning				.45	.32
Perceptual					.35
Numerical					

The highest correlations are associated with the verbal and reasoning factors; the lowest, with the numerical and spatial factors. Thurstone theorizes that a number of discrete, unitary, primary human abilities exist which are tapped in varying degrees in different intelligence tests. Opposed to this viewpoint is that of the English psychologist Spearman who, while recognizing the existence of special abilities, contends that a general intelligence factor underlies the special abilities. The existence of correlations between the primary abilities tests supports this view. Yet it can be argued that the correlations may not result from general intelligence as much as from impure tests, all of which require words as a vehicle for administration. The correlations decrease with increasing age, with the result that the relationships are lower in adults than children, supporting the concept of differentiation between abilities. Recent work by Guilford [10] outlines a topography of the structure of intellect, providing an integrated rationale for describing the many facets of intellectual performance.

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[9] L. L. Thrustone, and Thelma Thrustone, *SRA Primary Mental Abilities, Technical Supplement* (Chicago: Science Research Associates, April, 1954).

Relationship Between Intelligence and Learning

The correlation coefficients between the primary mental abilities tests and school achievement as reported by Thurstone are given in Table 2.2.

TABLE 2.2

			FACTORS		
Achievement	*Group*	*Verbal*	*Spatial*	*Perceptual*	*Numerical*
Reading	9-9.5	.75	.34	.43	.53
Reading	10.5-11	.85	.40	.40	.48
Arithmetic	4th. grade	.50	.30	.37	.44

A comparison of the data in Table 2.2 with those in Table 2.3 stimulates some conclusions regarding the usefulness of such tests in the school program. The correlations obtained between the intelligence tests and school subjects approximate those obtained by the aptitude tests, indicating that for all practical purposes as far as prediction of school performance is concerned, an intelligence test will be as useful. (This conclusion does not apply to adult populations, particularly in the matter of vocational choice and assignment, where aptitude tests can contribute significantly to better prediction of per-

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[10] J. P. Guilford, "The Structure of Intellect," *Psychological Bulletin*, 53 (1956), pp. 53, 267-293; and "Three Faces of Intellect," *American Psychologist* (1959), pp. 469-479.

TABLE 2.3

CORRELATIONS BETWEEN INTELLIGENCE AND ACHIEVEMENT IN DIFFERENT SUBJECTS AT THE ELEMENTARY SCHOOL LEVEL

Size of *r*	Number of *r*'s by size and subject			
	Reading	*Spelling*	*Arithmetic*	*Handwriting*
.90— .99			2	
.80— .89	6	2	1	
.70— .79	7	3	6	
.60— .69	12	7	2	
.50— .59	5	5	10	
.40— .49	4	4	6	1
.30— .39	4	5	6	1
.20— .29	6	3	1	1
.10— .19		2		
.00— —.09		1		3
—.10— —.01	2			1
Median *r*	.60	.51	.55	.08

Source: J. M. Stephens, *Educational Psychology* (New York: Holt, Rinehart & Winston, Inc., 1951), p. 228.

formance.) Although more specific information is obtained about a child's abilities which can be useful for certain diagnostic purposes, the energy, time, and funds expended are better turned to other channels, at least at the elementary school level.

Intelligence and motor learning. Infant intelligence tests consist mainly of various psychomotor tasks which permit a comparison of infant development with age norms. Results obtained from such tests show little correlation with later intelligence tests which depend mainly on verbal abilities. Studies of the relationship between intelligence tests and fine and gross motor performance show low positive relationships at best. Available data are extensive at early age levels but incomplete for adolescents and adults—as far as the data are concerned, there is little relationship between intelligence test performance and motor learning.

Family background and individual differences. Prior to entering school all children have experienced significant learning experiences which affect their subsequent progress in school. The primary agent providing this experience is the family. Friends play a secondary role, but gradually one's peer group plays an increasingly important role. Motivational patterns and attitudes are laid down in the family, and a major and basic segment of language is developed. Children use some 3000 words spontaneously by the time they enter school; their recognition vocabulary is four times as great. With the family serving to define a child's experiences for him, and interpret them to him, it is not surprising that wide differences in vocabularies, interests, attitudes, and personalities exist by the time of school entry. Television must be recognized as an influence, certainly in vocabulary development and quite possibly in attitudes and values. A recent study by Schramm [11] shows that children who watch TV enter school about a year advanced in vocabulary compared with students who do not. However, the difference disappears by the end of the elementary school.

A more significant role may be played by TV in influencing attitudes. From all evidence, however, the home is still the primary factor in the socialization of children.

Prior to World War II a number of sociological studies were carried out in American communities by the Lynds, Warner, and Havighurst, among others. These studies disclosed several social strata, each composed of individuals sharing common attitudes, experiences, value systems, and behavioral patterns, and having recognizable differences in status, prestige, and privilege. The terms "upper," "middle," and "lower" class were used to identify the classes, although occasionally the single division of "white-collar" —indicating professional, managerial, clerical, and sales workers— and "blue-collar"—indicating craft, industrial, and unskilled workers—were used. The strata are of interest to school personnel because of the differences in motives, goals, attitudes, and interests associated with the several strata, and the differences in child-rearing practices. Lower class parents were observed to be more permissive but also more punitive than middle class parents. The latter valued education more highly and held higher aspirations for their children. In addition, the middle class children tended to have a greater and richer range of experience. As interesting as these studies of sociological phenomena are, these facts are less interesting to school personnel than the observable consequences of them. Another source contributing in a similar fashion are rural-urban differences.

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[11] W. Schramm, *Television in the Lives of Children* (Stanford, Calif.: Stanford University Press, 1961).

When groups of children from differing socioeconomic backgrounds are compared on either intelligence or scholastic achievement, the differences favor the middle class over lower class children, and urban children over the rural. A glance at Table 2.4 will illustrate differences in intelligence relative to differences in parental occupation.

TABLE 2.4

MEAN IQ'S (STANFORD-BINET) OF CHILDREN GROUPED BY FATHER'S OCCUPATION

Father's occupation	*Age of child*	
	2-5	*15-18*
Professional	114.8	116.4
Clerical, skilled trades and retail business	108.8	109.6
Slightly skilled	97.2	97.6

Source: Quinn McNemar, *Revision of the Stanford-Binet Scale* (Boston: Houghton-Mifflin Co., 1942), p. 38.

A combination of factors undoubtedly contributes to the differences; environmental differences is one of them. Children who migrate from rural to urban environments show gradual increases in intelligence test scores, while those non-migrants in impoverished areas show gradual decrements. That the gains are not the result of selective migration is shown by periodic retests of the same children. If environment were the entire answer, a greater difference in Table 3.4 would occur between age 2 and age 15. But the differences between levels is nearly as great at 2 as it is at 15. Continued favorable environment would yield progressively greater differences, if it was the only factor. Hereditary influences undoubtedly play a part. Studies of identical twins raised in different environments show that there is a much greater effect on personality and temperament than on intelligence, suggesting the latter is less susceptible than the former to change as a result of environment. A third factor contributing to the difference is the content of intelligence tests. Davis, *op. cit.*, shows that intelligence tests favor upper socioeconomic levels because vocabulary content favors middle class children.

The influence of family background is of particular interest to the teacher because of its important role in shaping motives and attitudes toward school. Middle class mothers tend to be consistently more permissive towards children's expressed needs, more tolerant of expressed impulses, hold their children to higher expectations, and encourage initiative and responsibility. Bronfenbrenner [12] reviewed studies of child rearing practices and was able to show a progressive change through the past 25 years in all social classes towards more permissiveness. These findings are corroborated by Maccoby,[13] who found comparatively few differences in child rearing practices. Access to publications and particularly to TV undoubtedly contributes to decreased differences. But the fact that some differences continue to exist is shown by Schramm [14] when he notes that lower class children are more inclined to resort to TV for escape and fantasy purposes than middle class children, who are more reality-oriented.

Although intelligence tests may be loaded in favor of the middle class as far as vocabulary and test content, they are valuable in making predictions regarding anticipated performance of children in a culture which becomes progressively more middle class. This is to say that the white collar occupations are steadily increasing, while blue collar occupations are on the decrease. The point where caution in interpretation of the test score is in order is wherever one is making judgments regarding children who are immigrant from rural to urban or lower to middle socioeconomic levels. Such test scores must be used cautiously—inasmuch as they are likely to be influenced by environmental change, only short-range predictions based on them are advisable.

Motivation

Few teachers regard themselves as creators or shapers of motives, attitudes, and ideals. The professional role in which they visualize themselves is as transmitters of knowledge. The difficulties they face in fulfilling this role center in the motivation of their students. Inevitably, teachers find themselves trying to stimulate interest, encourage effort, and prevent boredom with the tasks which they present children. Whatever the procedures utilized, teachers are not only directing present motives, but shaping future ones. The bent they give to those motives and attitudes are fully as significant as the facts and concepts they proffer.

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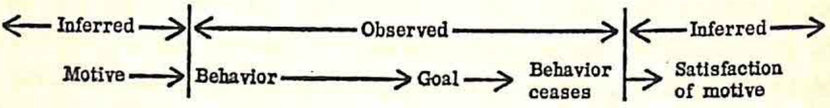
[12] U. Bronfenbrenner, "Socialization and Social Class Through Time and Space," in *Readings in Social Psychology*, eds. E. E. Maccoby, T. M. Newcomb, and E. E. Hartley (New York: Holt, Rinehart & Winston, Inc., 1958), pp. 400-25.

[13] *Ibid.*

[14] *Op. cit.*

Our knowledge about factual learning is much more extensive than our knowledge of motivation. The later is an all-encompassing term including such concepts as need, drive, purpose, goal, set, values, ideals, and so on. The term "motive" is more specific, referring to some condition or state of affairs within the child which gives rise to activity directed towards a goal. Our objective as teachers is to harness existing motives to the goals of learning, and to assist in the development of additional motives. To do this requires an understanding of the development and dynamics of motives.

We see behavior and make inferences as to what causes it. Diagrammatically, the situation appears thus:



We base our inferences on antecedent conditions and on outcomes. The Chairman of a Board of Prison Directors, a very short man, used to insist that his taller subordinates sit while in his presence. He was "compensating for feelings of inferiority associated with physical size"—referring to the antecedent conditions which gave rise to his actions. A common description of certain children is "attention-seeking" because of the apparent goal of the activity in which they engage. It doesn't help very much to name motives. Calling a child shy, fearful, or attention-seeking describes the obvious. Forty years ago, much of a man behavior was explained on the basis of instincts—man was instinctively aggressive, gregarious, acquisitive, and so forth. The doctrine of instincts failed because it merely categorized, it did not explain behavior. In animistic terms, it would be equivalent to explaining rainfall by saying that the earth had a raining instinct, or (as happened) that a rain god was the cause. Not until we developed some knowledge of the interplay of physical forces such as air masses at different temperature, moisture content, and the like could we understand such phenomena.

The complexity of motivational patterns in humans makes attaining a full understanding difficult. A variety of goals may satisfy a single motive. One's desire for status may be satisfied with a Cadillac, with money, with a professorship, or any other of a number of possibilities. Being a teacher may satisfy one person's security needs; in another it may satisfy a fear of adults, status needs, or desires to please parents. Yet, understanding of motivation is vital to successful teaching.

In looking at motives and attitudes, we are concerned with energy and the direction of it, and with the internal and external stimulus conditions which affect it. By the time children first enter school they have a basic motivational system resulting from the socializing experiences which they have had.

Maslow [15] has described a theory of motivation and its development which is useful to this discussion. He views motives as organized in a hierarchy which evolves from the basic physiological needs. We are born with physiological needs which must be satisfied if we are to survive. Deprivation of nourishment and fluid, extremes in temperature, body chemical changes, and other conditions cause activity. In the young infant the intial activity is a general arousal brought about by the experience of discomfort, but very rapidly such general activity is modified on the basis of experiences. The time schedule on which he is fed affects the rhythm with which he gets hungry or thirsty. The time allowed for feeding affects the speed with which he eats. The type of feeding—breast, bottle, or cup—affects the strength of the sucking response made. At first, an activity doesn't subside until food is received. But the child comes to respond to cues or signals in lieu of food—he will become quiet at the sight of the bottle in anticipation of the food; later, he will become quiet on hearing the sound of his mother's footsteps, knowing they signal food or care. Much later he will respond to verbal cues: *e.g.*, "We'll eat as soon as Daddy gets home." Not only will he learn to respond to signal and symbol as representative of satisfaction of his needs, at least temporarily, but he will also develop food preferences

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[15] A. H. Maslow, "A Theory of Human Motivation." *Psychological Review*, 50 (1943), pp. 370-96.

(affective reactions to certain classes and kinds of foods). He will learn ways of acting to get food and to eat it once he has obtained it, and he will begin to evolve a hierarchy of social motives as a result of the associational processes in effect. Behavior that successfully leads to satisfaction of a drive is reinforced by a satisfactory outcome; *i.e.*, need or drive reduction. Events which occur contiguous with the satisfaction of a primary drive acquire a reinforcement value of their own. The chain of events associated with feeding—being held, played with, talked to, smiled at, and associated with—acquire a positive valence, and ultimately, functional autonomy. They become ends in themselves and have the capacity to reinforce behavior. There is ample evidence from animal experiments that desires, appetites, and fears can develop through learning, and it is plausible that man's social motives evolve similarly.

Maslow sees a pattern of motives developing, starting with the basic physiological needs and the associated psychological needs of safety which lead children to prefer the known to the unknown, the familiar to the strange, and to avoid perceived danger. Next to develop are the affectional needs, in effect the desire for a person as a token or symbol of the satisfaction of basic needs. The needs for affection, love, companionship, and friendship fall in this group. In addition to acceptance, children wish to have the approval and recognition of the persons who play such a powerful role in regulating their lives. To have this approval enhances their sense of security, not to have it is threatening.

Such approval gotten, it is a short step to the identification of those qualities and actions which gain approval and those which do not. Self-appraisal reflects the appraisal we obtain from others. One develops a concept of himself as being to some extent a worthwhile person, and with it a degree of self-esteem. The concept of what we are good for and the desires we have to be like someone else, the models for identification, represent our self-concept and our ideal self. These are the kinds of motives that are in the process of major development by the time the child enters school. In addition, the procedures followed in the socialization of the child, the kinds of rewards and punishment, the severity of punishment, the affectional relationships and dominance-submission relationships within the family affect the degree of independence shown, the amount and direction of aggression, the degree of anxiety about expression of aggression, the effort at exploration and mastery of the environment.

The school is interested in the development of mastery and achievement, and in helping the child to realize as much of his potential for development as possible. These needs are at a rudimentary level in the first grader. The teacher's task is to create these motives by the way in which she utilizes existing motives, and the opportunities she provides for successful experiences which foster these motives. Physical comfort, safety and security, affection, approval, and self-esteem are the basic motives of the child, each in the context of a particular family having its unique behavior patterns and value systems.

Satisfaction of these motives is dependent upon the actions of others. In a classroom, the question of whether a child's needs for affection, approval, and esteem will be satisfied is mainly dependent upon the teacher, not only to the extent she has the capacity to satisfy them, but also the kinds of behavior she will approve. If the child can succeed in the latter, his needs can be satisfied and the path is open to him for development of achievement and mastery compatible with school objectives. Failing this, he will turn elsewhere for satisfaction of his needs and his behavior in school will reflect, not purposeful, goal-directed behavior, but frustration and tension.

Physiological drives follow a cyclical pattern of arousal, activity, satiation, quiescence—the theory of homeostasis, or equilibrium. Man's social motives are not as easily explained. The achievement of one goal stimulates further action—few millionaires have been fully satisfied by the first million. One of the characteristics of social motives is their persistence, and this is one of the properties that adds to the difficulties of understanding human motivation. Another characteristic is that of direction, the explanation of the selection of particular goals capable of satisfying motives. We can conceive of motives as being internal, tensional states capable of utilizing energy to reduce the tension. In hunger, the disparity between need and supply brought about by deprivation of food leads to food-seeking activity. In social motives, the disparities between what we are and what we wish we were, what we have and what we want, where we stand and what we fear, leads to actions designed to eliminate disparity. What we wish, what we want, and what we fear are learned. These expectations may be instigated by external or internal events, and the disparities may occur between two or more affective or nonaffective aspects of motivation.

For the child entering school a number of disparities automatically are created, and with them tension systems stimulating action. Most of these are on an affective level. The child comes from a home where (more often than not) he is accepted and loved as he is. Not that he is not criticized or punished, it is that he is loved regardless of his shortcomings. He is not especially conscious of status or ability differences. In contrast, he enters a classroom where he is but one of many, all of whom differ in ability, all of whom face a world of objective evaluation in which impersonal and detached judgment of performance is rendered. He must adapt to a regular schedule in which he has little choice of activity. Even the child who looks forward to school eagerly cannot avoid the disparities and resultant tensions, most of which are likely to affect his security, acceptance, approval and self-esteem needs.

The disparity can be nonaffective in nature. Yesterday, walking in a forest in Maine, I came into a pine grove which, judging from the orderly rows of trees at six-foot intervals, was a plantation. In the midst of the grove there stood a row of cut granite posts. The posts were about two feet high and ten feet apart. Anyone familiar with New England is not surprised to discover low, loose stone fences in the midst of the forest. The cut-stone posts were different —here was a disparity between expectations and events, which aroused and channelled activity. Following the row deeper into the forest, I found the stone fenceposts to have ten-foot-long pieces of granite the size of a curbstone running along their tops like a rail. I surmised that those closer to the road had been carried away, but this still did not provide an explanation. A short distance farther, the fence turned up a slope, at the top of which the stone posts were six feet high and formed an enclosure twenty feet square. Within the enclosure, to one side of a gateway, stood a family plot of three rows of graves, with low head- and footstones. Although the explanation was not complete it was sufficiently satisfying of the initial disparity to close the gap and bring the activity to an end.

The explanation of motivation in terms of disparities has two weaknesses—it does not explain how some gaps persist with no attempts made to close them; it does not explain efforts that persist beyond apparent satiation of motive. A northerner finds it difficult to understand how a southerner can espouse democratic principles yet resist public school integration. The contradiction is paradoxical to the northerner, who accepts the sharing of public services. The paradox would be more understandable to the northerner if he considered his reluctance to share residential areas with negroes. In this respect the northerner is as segregationist, perhaps more so, than the southerner. The explanation lies in the fact that the two concepts or percepts have to be related before the difference between beliefs and actions creates tension within the motivational structure. What we like and what we dislike must be related or have something in common before an impulse to act will be evident. As long as we can isolate one part from another, tension is not created and action to relieve it unnecessary.

Two events will occur to bring the activity to an end; the first, elimination of the tension by closing the gap. This may be brought about by an actual event, or it may occur through a fantasied event. A child can feign brightness by alertly pretending to want to answer every question. The alternate ending to effort is when the gap becomes so great that success is impossible. Few students strive for A's in the face of failing midterm grades, and some pupils, however able, perceiving the goal to be unattainable, will appear pseudo-feebleminded. Persistent efforts beyond apparent success suggest either alternate goals or a permanent disparity. The act of achieving, of winning, of dominating, of being admired can be an intrinsic goal in itself, prompting continued effort to this end. Uncertainties about oneself, feelings of inadequacy or inferiority, may prompt a continued effort to offset or placate such perceptions.

Attitudes have been defined as generalized mental and neural states of readiness to respond positively or negatively to certain objects, events, and conditions in the environment. They differ from interests in being general determiners of action or response where interests relate to attraction or aversion towards specific objects or activities. In short, an attitude refers to an affective state of readiness to respond. Attitudes play their role by determining the direction of activity, and hence are an aspect of the motivational structure influencing direction of behavior.

Application to education. The discussion of motivation has been general; in part, speculative. Nevertheless there are some applications to the classroom which have merit. Tension channelled into goal-directed activity is an essential condition of learning. Passivity yields little learning. Similarly, tension can be so great as to interfere with learning, for too much activity can ensue, resulting in fatigue and loss of economy in learning. The tension may be such that it interferes with attention to important cues as to right and wrong response, thus retarding learning. Side effects of persistent anxiety or excessive striving for unattainable goals can result. The child who is a perfectionist is an illustration of a child who is too anxious for high performance and is threatened by less than perfect performance. His effort is more likely to be focused on what is required to please the teacher than what is important in performing the task. High drive states can yield a higher frequency of error, particularly in initial stages of learning when the probability of error is higher.

The optimal degree of tension for learning is probably a fluctuating one, falling somewhere between indifference and certainty of successful performance. A constant degree of tension is likely to be inimical because of the occurrence within the learner of some form of accomodation or adaptation. Instead, tension states which are eliminated by progress towards the goal and ultimately fulfillment of motive are desired. It is probably not unlike sleeping and waking. The optimum condition is not the soporific midpoint between the two but a fluctuation between deep sleep and alert activity.

Tensions are created as much by fear as by desire, and in all probability we underestimate the amount of fear and anxiety which children experience in school. We get inklings in the Monday morning and test day "sicknesses" and in the school phobias, but these are the overt manifestations. Hidden are the subtle and covert fears which exist. Any adult who has tried to learn to ski knows the muted fear which makes him lean back on a slope and not commit himself to the hill. But he knows, too, the exhilaration that comes from the sudden reduction of fear when a sense of mastery comes, however imperfect technical skill may yet be. Some degree of fear or anxiety is not detrimental to learning. Yet the fact that it is pre-existing in many children makes caution necessary in any deliberate attempt to use fear as a motivator in the classroom.

Mention was made earlier in this section of the developing motives of the child and the tensions created by the disparities between home and school. In the primary grades, the existing tensions are likely to be in affective states, especially in relation to affection and approval. Reduction of tensions comes from the conviction that the teacher approves and likes the child—the gold star and other such symbols are basically signs of approval, not of achievement. Performance and achievement are seen as avenues for gaining approval, not as intrinsic incentives in themselves. As the child grows older, it is to be hoped that his successful performance will become a goal in itself and that the particular tasks he will face will be so designed as to develop intrinsic satisfaction. If prizes, gold stars, and other symbolic rewards are to serve effectively, they should be available to all during the primary grades as symbols of approval, and during initial phases of learning in upper grades as symbols of progress. Restricting them to a few high achievers is to maintain tension states at levels which ultimately become intolerable and finally are avoided by withdrawal. Dependence on such incentives leads to the erroneous notion on the part of the learner that the purpose in being in school is not to learn but to get grades, and that the purpose in getting grades is to get into college, rather than to have a purpose or goal in being there, even if it is no more than marriage. (No reflection on the desirability of marriage is intended, merely that colleges have other social purposes.) As achievement motives develop during the school years, and the capacities for independence and self-direction as well, the transition from the concern with affectional needs to mastery and independence can occur, and with it the development of intrinsic satisfaction in the activity at hand. There is probably no time, even in graduate school, when desire for recognition and approval is completely inoperative, but certainly they come to play a secondary role. During grade school, most children come with limited prior knowledge or expectations to a new subject. Granted that certain courses and certain teachers may have established reputations, nevertheless the basic problem is to overcome inertia and resistance where it exists, by whetting the appetite with a taste of the rewards in store, thus initiating a tension system, creating a goal which is within reach, manipulating a system of approval and disapproval, rewards and knowledge of results to encourage effort and give information as to correctness of response and stimulate progress toward the goal. Each step of progress, each subgoal attained, should be seen in relationship to a total task. With very young children the intervals have to be small; with older children, longer-deferred goals are possible. In a junior high school sheet-metal class, the instructor demonstrated the cutting, bending, shaping, and soldering of a scoop. There were many skills to be mastered by each boy before he could execute a similar performance, but to each the goal was attainable by clear steps. In another class, the instructor set the class to work with hammers and chisels cutting the face of a small metal block held in a vise, until the face was a uniformly plane surface. Surrounded by lathes, drill presses, grinding machines and other equipment, the boys chipped away day after day at their blocks. A few of the more skillful or fortunate eventually graduated to turning a nail set on a lathe. None could see purpose in the chipping, or any connection between it and lathe work. Motivation, initially high, steadily waned in the majority—few got past the task with maintained enthusiasm.

In the change to mastery and achievement motives, curiosity, exploration, puzzlement, and mastery are aspects of motivation which can be utilized to capture imagination, arouse energy, and direct it toward educational goals, and more to be depended on than extrinsic rewards and punishments.

CHAPTER III

The Learning Task

The ultimate measure of the effectiveness of school is not the amount of skill and knowledge acquired or the level of proficiency attained, but the amount and level retained and used (in this instance usefulness is viewed in its broadest meaning including aesthetic appreciation as much as direct application). Seen from this perspective, school curricula are to be judged by the degree to which their organization and development are consistent with principles of learning which foster retention and transfer of training.

Theoretically, the distinction between retention and transfer rests upon the similarity or difference between the test situation and the learning situation. When the situation in which learning is being tested replicates the situation in which it was learned, retention is being measured, but when the situations differ, transfer of training is being measured. Since all test situations vary in some degree from the original learning experience the distinction is difficult to apply in practice; hence, we are confronted basically with the general problem of transfer of training.

Most of our knowledge on the conditions affecting transfer, acquisition, and retention comes from laboratory experiments, which are usually designed to treat single aspects of a learning problem. Task conditions such as the similarity of materials, difficulty, meaningfulness, or affective response can be controlled and studied over a short period of time, as well as the interrelationships between several variables. In the schoolroom, the particular task is intricately wedded to the teaching procedures being used, and both are cast in a sequence of events and experiences called a curriculum. In this chapter we will be concerned primarily with the second element in the learning equation—the task which the learner must master, and the transposition of the knowledge obtained in the laboratory to the school setting. Several important features of the task which affect rate of learning, retention, and transfer are:

1. The perceptual clarity of the task.
2. The meaningfulness of the material.
3. The difficulty of the material.
4. Aspects of the task which interfere with the acquisition or retention of other material.

Perception

Learning to read involves a series of complex mental processes, important among them being word perception. Attention has to be given to a series of symbols called words which have to be discriminated one from another in order to recognize their meanings. In reading, three features influence the perception of words—the total configuration of the word, the detailed parts of the word, and the context in which it occurs. "House" and "horse," "boot" and "boat" are pairs of words having similar forms. The difference between each pair is the minute difference of a single letter. Yet few readers would need to check that particular detail in reading the sentence: "the rider spurred the galloping horse with his boot," in order to avoid reading it "the rider spurred the galloping horse with his boat." The contextual framework predetermines the words that can satisfy the situation and reduces the cues to which the reader must attend. Lacking context or given unfamiliar material, closer attention to such perceptual details is needed.

Since the organization or patterning of the sensory field is important in perception, it follows that learning is facilitated by well-organized perceptual fields. Visually, this can be demonstrated with two figures each consisting of the same number of lines.

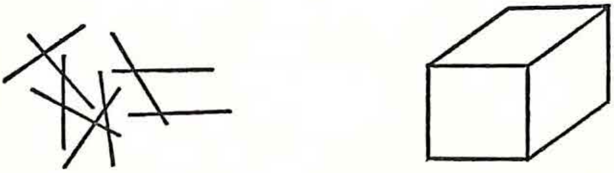

Figure 3-1. Illustration of irregular and orderly perceptual figures.

A similar situation exists in prose—rambling, disjointed sentences are difficult to perceive and comprehend. Several features in the sensory field affect the perceptual process.

Stimulus discrimination is essential to perception. In order to recognize differences in visual patterns and sound combinations one has to be sensitive to differences in color, form, shape, tone, rhythm, loudness, pitch, and also be able to perceive relationships between these differences. We perceive a melody because we are able to relate a series of sounds. We not only see a pear as green or yellow, but know the relationship between the color and the texture of the fruit. In reading, we go beyond the direct perception of an object, and associate an abstract symbol with an object or condition or class of events. The words "hostility" and "gentleness" are associated with certain kinds of attitudes and actions. In order to carry out this act successfully, we have to be able to perform this intricate skill—we have first to be able to make the visual and auditory discriminations necessary, and second to relate appropriate experiences to the symbols. Adults derive much amusement from listening to young children misperceive words or err in using a word from lack of clear knowledge of the kinds of experience to which the word refers, in essence, its meaning.

Our capacity to respond to color, sound, shape, or touch requires little or no learning. We do not have to learn in order to see lightning, feel rain, hear a bluejay, or recognize that letters have different shapes. But we do have to learn what lightning is, that the sound we heard identifies a bluejay not a robin, that the letter "u" is a vowel, the letter "v" a consonant. When the qualities of conscious experience refer to an object or event in the physical world, they have meaning. All perception involves the factor of meaning. When we see a table, a cloud, or leaves moving in the wind, we are perceiving an objective fact, but our knowledge of it depends on the particular experiences we are able to associate with this sequence and pattern of sensory stimuli, and this relationship is the product of learning.

To one who has not heard it before, the strange cry of the loon coming over a lonely lake at night sounds like the cry of a person in distress because of the relative amounts of experience one has had with the two sounds. After learning the "meaning" of the loon's cry by associating it with its source, it becomes what it is—the call of a beautiful water bird, not an anguished human.

Figure and ground. The drawings in Fig. 3-1 are perceived as wholes; the irregular one as a series of crosses, the orderly one as a cube. We see the lines as standing out from the white background, a figure against a ground, just as we see a tree against the sky, or a rose against the bush. Certain characteristic differences between the figure and ground exist. The figure is more definite, having fairly distinct borders which mark it off against the ground. Though complex, the parts form a definite pattern which can be viewed as a whole in comparison with the ground which is indefinite. Irrelevant details disappear into the background, unless special attention is called to them as in the instance of puzzle pictures in which one is instructed to find hidden faces or objects. Failure to observe significant features or figures produces erroneous perceptions.

Closure. A second important feature in perception is the desire to reach a satisfying end state. This takes the form of supplying missing parts and of attempting to make sense out of what is being perceived. Our viewing of objects and events is not the impartial record of the camera lens but a selection, an active effort to make sense of what is occurring. Hearing the screech of automobile brakes and a dog's howl, we infer that an auto has struck a dog. We glance at Fig. 3-2 and in all probability see it as a Christmas tree, yet it could be a sailboat. Many of children's errors in reading result from inadequate perception of the figure-ground relationships and from a closure based on perception which fails to discriminate essential differences. It is not unusual for a child to see that the first letter of a word are "wh" to read the word as "when" instead of "where" or "what" as the case may be.

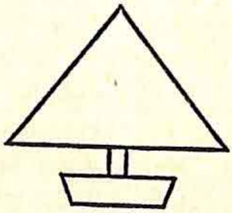

Figure 3-2. Abstract figure illustrating closure.

Meaningfulness of material. Reading requires not only word recognition, but knowledge of the meaning of words, the ability to comprehend the meaning of passages, not only literal but implied, and the ability to evaluate by relating to other sources of knowledge. At the first grade level, children have a use vocabulary of some 3000 words although they can recognize as many as 16,000 spoken words. The meanings associated with the words is derived from previous experience. Mutual understandings are possible because of common backgrounds of experience. There is small wonder that the word "democracy" means such different things when people from different cultures come in contact. The late-registering first grader who reported to his mother that the teacher was going to put him in the furnace on Monday didn't realize that the teacher's statement that she'd put him "on the register" next week referred to a class list and not to what his experience told him a register was; or the eight-year-old, unsuccessful in getting his friend to stop playing with a favorite toy, though mimicking his parents, was using the word in the context in which he'd learned it when he said, in a most authoritative and demanding manner, "Cooperate with me and put it down." Limited or inadequate comprehension of word meaning is one source of error, inadequate perception of stimuli another. Glasgow[1] compared the comprehension of prose and poetry as read by tenth grade girls, first when it was distinctly enunciated and secondly, when enunciation was deliberately made indistinct. Indistinct enunciation reduced the comprehension of prose only 5 per cent compared with a 42 per cent reduction in poetry.

In addition to knowledge of word meaning, groups of words must be comprehended. Consider the sentence *Just as smoke rises, warm air will also* __________. Without knowledge of the movement of warm air, it is clear that the analogy calls for a similar response. The need for the careful development of contextual meaning is often overlooked in the ease with which verbal facility can be obtained at the expense of meaning. If new subject matter is introduced detached from actual or contrived experience, it is not likely to be more than memorized by rote. Congenitally blind children in an academic program are especially susceptible to this difficulty. They can often parrot definitions and explanations with great facility, but lacking real experience they are unable to apply, demonstrate, or even transpose the meaning into their own words. Important as it is, classroom instruction is too often second-hand learning, an inadequate substitute for direct experience. Words intrinsically are nonsense syllables—only as they become associated with and stand for experience do they acquire meaning. It is impossible and unnecessary to provide direct experience in everything, but many techniques are available for creating and increasing meaning: pictures, films, drawings, dramatization, group discussion, cartoons, field trips, graphs, imitative experience, and others.

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[1] G. Glasgow, "The Relative Effects of Distinct and Indistinct Enunciation on Audience Comprehension of Prose and Poetry," *Journal of Educational Research,* 37 (1943), pp. 263-67.

If the discussion on the significance of experience for meaning has been prolonged, it is because the meaningfulness of the material to be learned is a most important feature affecting rate of learning and amount of retention. A study by Guilford[2] demonstrated this point. One hundred and seventeen subjects were each instructed to memorize three lists of words to complete mastery. The mean number of trials required were:

I.	15 Nonsense syllables	20.4 trials
II.	15 Unrelated words	8.1 trials
III.	15 Related words	3.5 trials

The importance not only of meaning but of contextual relationship is readily evident. Similarly, the more meaningful the material, the greater the retention of it. There are many studies which show that retention over various intervals of time is greater for substance learning than for rote learning. Significantly greater amounts of material learned by rote are forgotten than with sense of substance learning, even when the items are equated for differences in difficulty. The argument for the use of concrete rather than abstract materials, and direct experience rather than second- or third-hand experience, particularly with young children, rests upon such studies showing the greater learning and retention of meaningful materials.

Swenson's[3] study of the comparative effectiveness of teaching arithmetic to second-grade children by the drill method and the meaning method corroborates these views. In an experiment lasting

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[2] J. P. Guilford, *Laboratory Studies in Psychology* (New York: Holt, Rinehart & Winston, Inc., 1934).

[3] Esther Swenson, G. L. Anderson, and C. L. Stacey, "Learning Theory in School Situations," *Univ. of Minnesota Studies in Education* (Minneapolis: University of Minnesota Press, 1949), pp. 9-39.

20 weeks, the one-hundred arithmetic facts, 0 + 0 to 9 + 9, were presented in three sequential sets. In the groups taught by the generalization method, the facts which center around a generalization were presented together and the children were encouraged to discover their own generalizations; *e.g.*, when you add 0 to another number, the other number stays the same; if the numbers are upside down, the answer is the same. After the generalizations had been achieved practice exercises were given to aid understanding. In the drill groups the addition facts were presented as isolated facts. Speed of response was emphasized, using fingers was discouraged, errors were corrected immediately, and drills were made interesting and varied. By presenting the facts in three sets it was possible to check initial acquisition, retention, and interference and transfer between sets. In this study the advantage went to the generalization groups—initial learning was greater, and there was greater transfer and less interference. In relation to amount learned, the amount retained by both groups was equal.

Such findings are of direct practical significance. All material should be made as meaningful as possible. Learning of addition and subtraction facts should be accompanied or preceded by direct experience. It is purposeless to ask children to spell meaningless words. Historical, geographic, and scientific facts are rapidly forgotten unless reinforced by relevant experience. Dates and names are valueless as isolated facts; they must be incorporated into larger units of understanding—one of the difficulties we have in learning names of persons lies in the fact that they convey no meaning. Anyone who has placed many long distance telephone calls knows how easily operators can garble a name as it is passed from one operator to the next. Meaningful organization of materials can be developed by attention to similarities and differences, and by emphasis of the who, what, when, where, and why of relationships.

Difficulty of material. Logically, learning should proceed best from simple to complex, from part to whole, but experimental results on the idea have not been consistent. True, with certain complex tasks the interplay of the several parts is sufficiently interdependent that it is more effective to practice on the total task than to practice separately on the component parts. Driving an automobile involves a complex of responses in steering, accelerating, and braking which have to be linked to a complex field of stimuli—speed of vehicles, road conditions, density of traffic, spatial relationships between objects, etc. Practice on the separate response segments of accelerating or braking is less effective than on the total task. Stephens [4] has suggested that practice on the complex task is preferable where a reasonable degree of success is possible, but lacking this practice on a key part or simplified whole is indicated.

Retention

Curves of forgetting generally show greater forgetting of verbal material than of motor skills. Available evidence suggests the difference is not due to greater difficulty of the verbal material so much as to the fact that motor skills are overlearned to a greater degree than verbal materials. In experiments where the differences in practice have been controlled, retention is equivalent for both.

Ever since Ebbinghaus's pioneer work on learning and forgetting with the nonsense syllables which he invented in order to have learning tasks free of previous experience, a fixed idea has existed about the fact and rate of forgetting—a rapid initial drop followed by a gradual slide to nearly complete forgetting. The fact of forgetting is true, but the rate is not fixed. Ebbinghaus was working with meaningless material, and to the extent that school work is disorganized, unrelated, and meaningless, the classical forgetting curve will probably apply. For meaningful learning, and for situations where overlearning or periodic recall occurs, the curve of forgetting will vary considerably.

Children have been tested in various subjects at the end of the school year and again in the fall after a summer vacation. Considerable variation in forgetting occurs, from losses to actual gains, with the tendency to gain occurring more frequently in the intermediate grades than in the primary. Reading ability tends to rise during the summer, due probably to continued practice in reading as a recreational activity. Gains in history and arithmetic have been reported, but the gain usually occurs on the easier material. The more difficult material is more susceptible to forgetting.

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[4] J. M. Stephens, "Transfer of Learning," in *Encyclopedia of Educational Research*, ed. C. A. Harris (New York: The MacMillan Company, 1960), pp. 534-43.

Losses in arithmetic computation occur more readily than in problem solving ability, particularly on the more difficult materials. Simple computation skill shows little loss, sometimes gain. Brighter pupils show greater retention than their less-apt classmates.

Studies at the secondary level suggest greater losses, with proportion over the summer ranging from 10 per cent to 50 per cent. General principles are retained to a greater degree than factual information in which the greater losses are registered. In high school and college chemistry, high school seniors have shown a 42 per cent loss over a period of three months, and an 80 per cent loss over five years.

Available information indicates that factual information is forgotten faster than the ability to explain, interpret, and apply general principles. At the college level the greatest loss is in technical material. The amounts of loss ranges 50-90 per cent on factual information, but only 10-40 per cent in general principles. Certainly any improvement in the technology of teaching which reduces the amount of forgetting is desirable. This holds true only if the material being learned is worth remembering. The fact that we forget as much of what we learn can be a blessing in disguise if the materials are gauged for their value, both factually, practically, and aesthetically. The rapid rate at which knowledge becomes obsolete in the present era supports the need for selective forgetting.

Interference in Learning

Forgetting is less a result of loss from disuse than a process of active elimination. Each new bit of information, each new degree of skill, each addition to our repertoire of knowledge either reduces the availability of some previously acquired knowledge or skill, increases the difficulty of some subsequent addition, or both. What we learn today is a barrier to recalling something we've learned before and probably to some future learning as well. Were this interference in learning all that occurred, the task of advancing our knowledge would grow progressively more difficult, but fortunately there are positive effects as well. Old learning can have positive transfer to new situations and facilitate performance. "Retroactive inhibition" is a term used to describe the interference new material works on recall of previously learned material. "Proactive inhibition" describes the interference of old material with new. The usual procedure for studying these phenomena is to provide a control group with certain material to learn. Following a rest period (which typically involves some minor activity to prevent review of the learned material), the retention of the control group is measured, usually by the relearning or savings method. This is a measure of the number of trials required to bring performance up to the original level of learning. By introducing a second learning task instead of the rest interval, the amount of interference can be measured by the greater number of trials experimental groups require to relearn the original material or the subsequent material, as the case may be.

Similarity. The amount of retroactive inhibition is a function of similarity of the materials and of the method of operation as well. Although variation occurs according to various experimental arrangements, in general it may be said that, as the degree of similarity increases, so does the amount of interference. The greater the dissimilarity the less the interference. Thus, for students learning two foreign languages, greater interference between French and Spanish would be anticipated than between French and Chinese. If both French and Spanish were taught by the same procedure—the traditional reading, vocabulary, grammar procedure—interference would be greater than where one was taught by an audio-lingual procedure. Interference would be greater between those aspects of the languages having similarity of meaning or form, than between aspects quite different.

Degree of learning. Interference is at maximum when the degree of learning of both the original and the interpolated task is at the same level. Overlearning on the original task reduces the retroactive effect. Interference with the recall of old material increases however as the amount of practice on the new material increases up to the point of mastery. Taking the French-Spanish combination, the least desirable arrangement would be to provide equal amounts of practice on both subjects. It would be preferable to overlearn on either or both. Correspondingly, the greater the amount of each which one attempted to learn on a given series, the greater the interference likely. Again, the amounts of the two should preferably be unequal.

Time schedule. The amount of interference is greatest when the two activities are pursued close together in time. The interpolated task interferes more when it closely follows the original task, or when it closely precedes the recall of the original task.

Organization. Studies indicate that subjects do not learn the original and interpolated tasks as entirely separate units, but tend to organize them into a comprehensive pattern that includes both. Where high associative values exist between the two tasks, interference is greater. Where associative value is low, interference is low, in spite of the degree of similarity of the materials. Thus the internal organization within a task and the relationship between tasks will affect the amount of retroactive inhibition. Preferably the two tasks should be isolated from each other in the total organization of behavior, if intertask interference is to be minimized. Data from the laboratory experiments disclose the following as affectors of learning and transfer:

1. The perceptual clarity of the task, in points of relevant cues and appropriate responses.
2. The meaningfulness of the material and the understanding obtained.
3. The context in which the skill or knowledge is acquired.
4. The difficulty level and complexity of the task.
5. Conditions contributing to or reducing the interference between tasks such as similarity of stimuli or responses, and degree of overlearning.

Transfer in Relation to School Subjects

In general, experimental evidence obtained in school settings supports the laboratory findings. One significant difference is the lower degree of transfer of training observed, particularly between school subjects. For instance, many studies of the contribution of high school science to college achievement in science show no contribution. This is understandable if one reviews the organization of school curricula in relation to the factors listed above. In the laboratory we find singular aspects of learning being manipulated under carefully controlled conditions. Ultimately, however, each of the aspects must be seen as part of the total curriculum, not only the formally described set of facts, skills, concepts, and activities which comprise it but also in relation to the provision for individual differences, motivations, interests, and attitudes.

Curricula can be classified as subject-matter centered or experience centered. In effect, a curriculum is an attempt to relate subject matter and individual experience, the logical and the psychological, in a way which attains the desired objectives of education. Subject-centered curricula have been organized in three forms: subject matter, correlated subjects, and broad fields.

In the subject matter curriculum, the emphasis is on facts, skill, and knowledge, with the subjects presented as separate tasks during individual periods and predetermined rates. In the secondary school time allocation is determined by the number of periods per week assigned a given subject; in the elementary school standard periods are lacking, but rigidly observed time schedules in which a specific amount of time per day is allocated to each subject or skill, such as reading, prevail in a number of cities.

The correlated subjects curriculum is an attempt to relate separate subjects to each other. History and geography, science and health education, or geography and economics, though taught separately, may be presented in a manner that emphasizes the relationships between the two.

From correlated subjects it is a short step to the broad fields curriculum, in which the language arts are considered as a whole, and the separate phases of communication—listening, speaking, reading, and writing—are treated as parts of the whole. The same approach can be taken with the social sciences, the arts, or other subjects.

The experience (developmental activity) curriculum places emphasis on the learner, on his interests and abilities, and on his personal, social, and intellectual growth. Its problem is how to use the physical and social environment of the school to provide experiences appropriate to developmental level. In practice, the difference between subject-centered and child-centered curricula can be difficult to detect, but the difference in emphasis is clear. In the former, knowledge and procedure is preestablished, and the task of the child is to make his responses congruent with the established model. In the latter the emphasis is on exploring, analyzing, problem solving. Carried to an extreme, the child would find himself exposed to a range of materials suitable to his interests and developmental level. He could start at any point and proceed at his own pace, assisted and encouraged by the teacher. If this procedure were followed in college, one could begin psychology at any point—social psychology, child psychology, abnormal psychology—instead of with an introductory course. Ultimately, because of the basic inter-relationship underlying all knowledge, one would move through the entire field of psychological knowledge, as long as interest and ability were equal to the task.

The core curriculum is a type of curriculum which can be applied to any of the preceding curriculum, for it identifies central and peripheral learnings. Commonly associated with the broad fields and developmental activity curricula, it puts an emphasis on the study of broad social problems confronting society, the conditions which gave rise to them, and possible solutions to them. An analysis of the general types of curricula described in comparison to the conditions which promote transfer of training indicates that, however well taught the individual subject may be, the total school day or school week combines a complex of tasks in which the probability of the following is:

High

The context is one in which relevant cues and responses are difficult to discriminate

Task difficulty is great

Interference because of similarity of teaching procedures

Rote learning of principles as well as facts

Low

Structural relationship between parts of curriculum

Adaptability to individual differences in ability and interest

Time schedule permitting optimum practice and overlearning

Opportunity to evolve and apply generalizations

Most teachers take positive transfer of training for granted, assuming that the material they teach contributes greatly not only to academic achievement in other areas, but also to the student's adaptability to life. Unfortunately, research does not support the assumption. In the main, the degree of transfer is fairly low, even negative on occasion, with percentage gains ranging from 0–25 per cent. Thorndike[5] in an early, large scale study showed that little transfer occurred between subjects in a high school program which included algebra, geometry, chemistry, Latin, English, and foreign languages. His finding has been repeatedly confirmed. When transfer to more abstract skills such as problem-solving or reasoning ability is considered, the amount of transfer is negligible. Yet enough evidence exists to indicate that remedy is possible, provided the emphasis in instruction is less on sheer acquisition and more on transfer. In order to make that shift the instruction must provide:

1. Practice in a variety of contexts and with a variety of materials.
2. Understanding of the feature to be transferred.
3. Opportunity to develop meaningful generalizations.
4. Opportunity to apply the generalizations.
5. Information regarding possibilities for transfer.

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[5] C. R. Broyler, E. L. Thorndike, and Ella Woodyard, "A Study of Mental Discipline in High School Studies," *Journal of Educational Psychology*, 18 (1927), pp. 377-404.

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CHAPTER IV

Teaching Procedures

The learner arrives at school with his own particular abilities, motives and experiences. Nothing can be done by the teacher to change the earlier experiences, but she may be able to provide the learner with a new perspective for the events and of their relation to the future. The learning tasks for a given grade are largely set by the curriculum, which restricts the teacher's freedom of choice. She can, if she chooses, ignore individual differences between learners and, setting out upon a prearranged schedule, present the group tasks, letting the chips fall as they may. This is the procedure one finds in most college courses, for it is implicitly assumed that provision for individual levels of ability and rates of progress is unnecessary.

An alternative procedure is to attempt a match of the learner's capacities with a suitable task. Students in college at least have some degree of choice in the matters of which college and what courses, parental pressures notwithstanding. Children between the age of seven and sixteen have no such choice. They are legally committed to a term in school which is as long as that of the average prison sentence for first degree murder. Fortunately our schools are such that most children would attend voluntarily without the presence of compulsory school attendance laws, yet the fact that one-third of the children leave school before high school graduation indicates that much improvement is needed in providing suitable learning experiences for children. It is socially stupid to maintain a policy of compulsory attendance which forces many children to face persistent failure. Certainly not all school dropouts are the result of inadequate curricula. Social-class attitudes and economic circumstances are among the causative factors, but the fact that many dropouts occur as a result of failure to provide learning experiences suited to individual differences should be of great social concern.

Although the teacher cannot change the child's history, she can appraise his capacities, analyze his needs, select suitable tasks, and —most important—present them in a manner that is effective. The selection of meaningful tasks, the provision for learner activity, the stimulation of use situations, the adoption of appropriate methods, and the provision for evaluation of progress are the areas in which professional teaching skills are demonstrable. It is within the basic sources of content—books, mass media, teacher experience, learner experience—and the methods and activities available—texts, lectures, laboratory, individual projects, workshops, forums, panel discussions, homework, recitations, quizzes, demonstrations, buzz sessions, films, teaching machines, field trips, dramatic presentations—that the opportunity and need for professional teaching skill exist. Other volumes in The Library of Education Series provide detailed descriptions of specific activities and procedures appropriate to given subject matter. At this point we should look to the general principles which determine and support teaching procedures.

Distribution of Practice

Learning was defined as "the process by which behavior is initiated or changed through practice." In conventional usage, practice includes the time or trials spent in both the acquisition and retention phases of learning. We practice to master a skill; having mastered it, we practice to maintain it. Psychology makes a distinction between the acquisition and retention phases of learning, using "practice" in reference to the time or trials spent in the former, and "overlearning" ("drill") in reference to the latter. It is true that once some degree of skill is attained each succeeding trial not only serves to advance the level of skill but to retain that which has been accomplished; nevertheless, the practice phase is basically that which precedes the attainment of a given level of mastery.

The fixed lengths of the school week and year necessitate some allocation of time to each of the component parts of the curriculum. Such allocations may be determined a priori or in relation to pupil progress, but either involves a decision as to how much practice to give and in what arrangement. Practice may be spaced or massed; *i.e.*, spread out over time or concentrated in a continuous period. The typical daily schedule gives a little bit of time to each subject or skill each day, but it could easily devote a single day of each week to a particular subject, thus concentrating practice in larger doses. Some colleges adopt an even more intensive arrangement, massing all the work in a given area into a single quarter or semester. A student spends one semester studying the humanities, another the arts, psychology in a third, and so on. Do all of these arrangements work equally well, or are there limitations which must be observed?

Practice arrangements have been widely investigated with many different kinds of materials. The results of the research have been quite consistent; namely, that under most circumstances distributed practice is superior to massed, in points of amount of learning and retention. There are three elements to be considered in the spacing of practice: length of practice period, length of rest period, and interaction between the two. In general, provided it is not too short, shorter practice periods yield greater amounts of learning. In one early study [1] a 30-minute practice period proved more effective than 15-, 45-, and 60-minute periods on a substitution task. Hovland [2] carried out a number of experiments in which the length of work and rest periods were systematically varied in relation to length of task (memorization of nonsense syllables). In all instances distributed practice was superior; the more involved the task, the greater the superiority. In experiments comparing massed with distributed practice the total amounts of time spent in practice may be equal, but the distributed practice usually requires a longer time period because of the insertion of the rest intervals. Duncan [3] (1951) controlled this condition by setting a maximum time of 20 minutes for each of two groups. Each group practiced for two 5-minute periods and rested for 10. The massed-practice group practiced continuously during the work period; the distributed-practice group alternated 10-second work with 20-second rest periods during the two 5-minute periods. Distributed practice proved superior.

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[1] W. H. Pyle, *The Psychology of Learning* (Baltimore: Warwick & York, 1928), pp. 44-45.

[2] C. I. Hovland, *Experimental Studies in Rote Learning Theory, I-VII, Journal of Experimental Psychology,* Vol. 25-27 (1938-40).

[3] C. P. Duncan, "The Effect of Unequal Amounts of Practice on Motor Learning Before and After Rest," *Journal of Experimental Psychology,* 42 (1951), pp. 207-264.

Length of rest interval is not as important as length of work period. It appears that any amount of rest is better than no rest as far as learning rates are concerned, and that generally the longer the practice period the longer the rest period desirable. But the effective length of the rest period apparently varies not only with the amount of work performed but with the type of work performed as well. In motor learning, short rest intervals appear optimal. The work decrement resulting from practice disappears rapidly during the first two minutes, slower thereafter. Athletes know that short rest periods reduce the effects of fatigue without allowing excessive loss of body heat.

The length of the practice period should be short when new motor tasks are being introduced for the first time, especially in the elementary school where differences in readiness, interest, and attention span are noticeable. The more difficult and complex the skill, the more liberal should be the distribution of practice. Many motor skills involve complex mental or social skills as well as complex motor performance—typing, for example, requires spelling and language skills in addition to speed and accuracy of finger movement, and basketball involves complex regulations and coordinated group action as well as athletic skill.

Given rest periods, interaction between work and rest is not critical. Apparently short work periods and short rest intervals are desirable during introductory phases, with a gradual lengthening of the practice periods indicated. Length of rest period can vary as long as it doesn't become so great as to allow forgetting to become complete.

There are certain conditions under which massed practice is desirable. If gradual lengthening of work period is pursued, a gradual transition to massed practice occurs. Massed practice is desirable when peak performance of a well-established skill is required. Cramming for examinations is such an occasion, provided it has been preceded by adequate practice in and mastery of the knowledge or skill. Unfortunately this is often not the situation; inadequate learning and poor retention are reflected in marginal performance on examinations. Where insight into a set of relationships is an essential condition of learning, massed practice is helpful. This frequently involves learning tasks to which high degree of transfer of training from previous learning is possible. The final kind of learning situation improved by massed practice is that in which prolonged warm-up is needed to attain an adequate performance level. Preparation of term papers, essays, and the like is typical of such tasks. Here proficient assimilation, and organization, and reorganization of information into related segments requires continuous practice—ideas are more frequently dragged out by the heels from the recesses of thought than born, like Venus, full-fleshed.

A number of explanations have been offered to explain the advantages of distributed practice. The opportunity for rehearsal during the rest interval and the dissipation of fatigue during that time were seen as two possibilities. However, rehearsal has been controlled without changing the results, and the advantage of distributed practice remains in situations where the task is such as produces little if any fatigue. McClelland[4] attributes the advantage to a performance decrement, contending that performance lags behind actual learning during the acquisition of a new skill.

The evidence on the whole supports the operation of two factors; one suggested by Hull[5] and his associates, the other by McGeoch.[6] Hull postulates the existence and development of two kinds of inhibitory tendencies of work in every learning situation. The first is an innate inhibition resulting from reluctance to repeat a response. The greater the amount of work involved in an act, or the more frequent the number of times the act is repeated within a given period of time, the greater the inhibition. The second kind of inhibition is conditioned inhibition in which traces of faulty associations accumulate. Hull sees both as being dampers on performance which disappear during the rest interval. McClelland's and Hull's views are highly similar.

The factor proposed by McGeoch to account for the superiority of distributed practice is an interference factor which causes differential forgetting. In any learning situation, interference between the materials being learned occurs. The more similar the materials, the more interference. Also, in any learning situation where either reward or confirmatory information is provided, actions which are rewarded or lead to success will be retained longer than those responses which do not; *i.e.*, in differential forgetting, those responses encountering the most interference or the least reinforcement are forgotten the most rapidly. The net effect of a rest period is to facilitate the forgetting or dropping out of error. From the foregoing discussion, it appears advisable to space practice when:

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[4] D. C. McClelland, "Studies in Serial Verbal Discrimination Learning," *Journal of Experimental Psychology*, 31 (1942), pp. 44-56, 149-162.

[5] C. L. Hull, *Principles of Behavior* (New York: Appleton-Century-Crofts, 1940).

[6] J. A. McGeoch, *The Psychology of Human Learning* (New York: Longmans, Green & Co., 1942).

1. The amount of work involved or the length of the task is great.
2. The task is not meaningful.
3. The task is complex.
4. The frequency of erroneous response is likely to be high, especially during initial stages.
5. Motivation is low or amount of effort required high.

Massed practice is preferable when:

6. The task is highly meaningful; insightful learning is possible; or high degree of transfer from previous learning likely.
7. When previously learned skill has been brought to a high level of proficiency, even though considerable forgetting has occurred.
8. Peak performance on well-known knowledge or skills is required.
9. A prolonged warmup period is necessary for productivity.

New tasks should be introduced to school children in small amounts, and initial practice and rest periods should be short, followed by gradual lengthening of the work period. Considerable flexibility in scheduling is permissible as long as rest intervals are not so long that complete forgetting occurs. A fixed schedule which gives uniform time allocations throughout the year cannot possibly provide suitable variations in practice period. Instead of starting a year by spending all of the time reviewing previous learning, some new tasks should be introduced and gotten underway, permitting a sequential introduction of new tasks with variable practice periods possible.

Overlearning

Drill prior to mastery of a skill or acquisition of knowledge is fruitless, for unless the material is learned correctly it fixes error responses or produces negative transfer. A good illustration is the common practice of requiring children to write every spelling word five times. In copying words from the blackboard, a child is likely first to copy the word on the board, thereafter copy the word he has written. An intelligent fourth-grade boy carrying out such an assignment produced the following:

November Noveber Novebr Nvebr

His spellings resulted in part from a difficulty in reading his own handwriting, partly from the drill of error responses. Instead of looking back to the board each time for the correct stimulus, he looked to his reproductions and the errors they incorporated. Clearly it is essential that mastery precede drill or overlearning.

Kreuger[7] compared the effect upon retention of 50 per cent overlearning and 100 per cent overlearning, after a series of learning trials in which 12 nonsense syllables were learned to the end of one perfect performance during a single presentation. Whatever the number of trials taken to learn the syllables, 50 per cent more trials were given in one treatment, and an amount of drill equal to the learning trials in the 100 per cent treatment. Retention was tested at intervals of 1, 2, 4, 7, 14, and 28 days. Retention was superior at all time intervals for both degrees of overlearning, but only slight differences were observed in advantage of the 100 per cent overlearning compared to the 50 per cent method. The study indicates that overlearning, at least to the 50 per cent degree, increases retention and that the longer the interval, the higher the value. Certainly these findings are significant for memory drills and for other cases where long retention is desired.

To be effective however, overlearning requires the same degree of attention as during learning, which is often not the case in the classroom situation. Furthermore, it indicates that the amount of drill should be varied according to the length of time it takes a student to learn. The more the conditions under which practice and drill are similar to the conditions under which the skill will be used, the more effective practice and drill will be. Typing nonsense syllables will not be as useful as typing words. Practice in pronunciation of single words of a foreign language will not contribute greatly to skill in speaking the language. There are undoubtedly many places in the teaching of arithmetic and spelling where drill procedures can be markedly improved, if by no more than variations in amount of drill. When Brownell and Chazal[8] checked on the procedures being used by third grade children in making arithmetic computations after two years of training by drill methods in grades 1 and 2, they found that only half the children based their answers on immediate recall. The other half were counting, guessing, or using indirect methods. After a month of daily drill in the third grade, one-third of the class were still not using rote memory, indicating the inadequacy of straight drill as a teaching method.

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[7] W. C. F. Kreuger, "The Effect of Overlearning on Retention," *Journal of Experimental Psychology*, 12 (1929), pp. 71-78.

Recall that in retroactive inhibition, differential amounts of practice on two tasks reduced the amount of interference. Similarly, as materials are overlearned, the interference decreases, and positive transfer increases.

Guidance of Learning

There is a real art in knowing when to step in and give instruction and guidance and when to let the learner practice on his own. Errors are unavoidable in the course of learning; they can be helpful as long as they contribute to a knowledge of the appropriate actions. An unfortunate effect of instructional practice and the feeling children get that errors per se are bad is their consequent reluctance to try for fear of making errors. Careful analysis of any given skill is needed in order to contrive learning exercises which yield the development of the desired skill with minimal efforts. Several steps can be followed in guiding learning activities:

1. Analyze the skill.
2. Demonstrate the skill by part or whole.
3. Guide initial responses.
4. Provide appropriate exercises.
5. Provide knowledge of results, preferably intrinsically.
6. Help the learner evaluate performance.

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[8] W. A. Brownell, and Charlotte Chazal, "The Effects of Premature Drill in Third Grade Arithmetic," *Journal of Educational Research*, 29 (1935), p. 17.

Analyze the skill. This is the responsibility of the instructor and is for the purpose of clarifying the instructor's understanding of the task so that he can teach the component parts in the simplest fashion possible. Confusion results when an amateur dance instructor begins with, "You start off with your weight on your right foot; step forward with your right foot; no, that isn't right, your weight is on both feet." The results of such analysis are conveyed to the learner in the form of the exercises chosen and the demonstrations given. A few years back, it was common practice in skiing to teach the novice the various weight and balance shifts involved in a given turn: "As you are traversing the slope, your skis are parallel, slightly more weight on the downhill ski. As you approach the turn, put your weight on your downhill ski; counterrotate your shoulders and hips; stem one ski; release the edges of your skis by leaning down the fall-line. As your skis come into the fall-line, rotate hips and shoulders and shift weight to the downhill ski as you complete the turn." The novice had difficulty recalling the sequence of events, to say nothing of executing them—his perception of movements was sufficiently delayed that the action got away from him. Today, instruction would begin by dividing the sequence into a series of components, each of which is an integrated unit, not a meaningless fraction, and devising for each an exercise which demonstrates the action, *e.g.*, having the novice raise his uphill ski as he traverses a gentle slope.

Demonstrate the skill. Although little attention is paid to imitation in formal discussion of learning, imitation serves many purposes which go unrecognized, particularly in motor learning. A skill has to be demonstrated in the manner the student will be expected to perform it. An instructor who has his students facing him is providing them with reversed demonstration. The mere presence of the model isn't sufficient—he must be a model who demonstrates clearly what to do. For instance, training in the assembly of a piece of equipment or the operation of a machine is more effective if the learners are behind the instructor rather than surrounding him. The effectiveness of filmed demonstrations and closed circuit television in medical schools is ample testimony to the value of demonstration. Ample research evidence exists to support the empirical demonstrations of such techniques as surgical operations to demonstrate the value of the enlarged visual image provided by film, not only for demonstrations of technique but also for general principles.

Imitation is a major means by which children learn motor skills, acquire language patterns, gestures, attitudes, and a wide variety of social behaviors. A strong argument can be advanced for equating imitation and identification. However defined, there is no question regarding the roles that imitation, reciprocity, and demonstration play in learning. In fact, the educational value of the so-called educational toys which are replicas of household equipment is found in the real equipment that provides repeated demonstrations. Nash[9] has reported how the complex skill of operating a cotton textile machine is taught entirely by demonstration in Guatamala. The apprentice stands by the machine and observes the operator perform the series of responses required to operate the machine. The training proceeds entirely by demonstration and observation, without any instructions, questions, or opportunities to practice. When the apprentice thinks she has mastered the procedure, the machine is turned over to her, and usually with successful results.

Guide initial responses. Many skills have two component parts, a motor part and a perceptual part. Dancing, skiing, and running have high motor components but low perceptual. The cues to performance are mainly kinesthetic and have to be sensed internally. Learning follows a course of gradual approximation and refinement toward perfection of the correct response. Verbal instruction is easily overdone and confusing because it fails to call attention to the correct cues for judging and correcting performance. The child learning to row a boat and keep it going in a straight line will become quickly confused and discouraged by a series of verbal commands attempting to correct the veering: "You're going in a curve; pull harder on the right oar; you pulled too hard, now pull on the left oar; don't put your left oar so deep into the water. . . ." Manual guidance can be of assistance where the pattern of movement is not clear, but the fact that learning a motor skill requires voluntary control of movements regulated by the central nervous system places definite limits on its value. Reading, speaking, and map reading are skills with high perceptual, low motor components. Verbal guidance can be valuable, but it should be positive and focus on appropriate cues. The learner should be told what to do rather than what *not* to do, by concentrating on the goal to be achieved.

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[9] M. Nash, "Machine-age Maya: The Industrialization of a Guatemalan Community," *American Anthropological Association,* No. 2 (1958), p. 60.

Provide appropriate exercises. Pupil skill analyses made by the teacher should lead to the development of exercises that will improve skills. The author vividly remembers an example of superb teaching. A French phonetician instructed a group of men for an hour at a driving pace on the distinctive pronunciations of two phonemes, the vowel sounds in *je* and *j'ai*. The task is superficially such a simple discrimination that it would seem impossible, and unnecessary, to hold a group of adults, even novices, at the task for that length of time. The group was composed of fifteen men from a dozen different countries in Asia, Africa, and the Americas. The instructor proceeded through a series of simple repetition exercises of single sounds, which she corrected man by man, then of combinations of the vowel sounds with the same consonant, then through a series of progressively longer and more intricate combinations of consonant and vowel sounds requiring finer discriminations, both in listening and speaking, in order to accurately distinguish the intended meaning. With an ear as acute as a symphony conductor's for a false note, she detected faults in pronunciation, located the erring member, and then worked with him quickly on a particular combination. Her talent was such that she was able to provide special drills for particular errors associated with a particular mother tongue. For example, those who speak English, Spanish, and Japanese each have unique difficulties learning to pronounce the French "r," because in each of their languages the closest native sound is only an approximation and is created differently. Such special drills are a result of careful analyses of many languages. Such careful analysis and development of special exercises is needed in many subject areas.

Provide knowledge of results. An effective guide to improved performance is knowledge of the results of any response. In perceptual-motor learning, automatic feedback of results is an inherent part of most situations. The pilot landing a plane is aware that an angle of approach is too steep, even before the jar of the wheels on the ground. The overstroked tennis drive on its way out-of-bounds is sensed immediately. But in other forms of learning performance is not as readily judged. The pronunciation of sounds in a foreign language depends not only upon vocal mechanisms but upon auditory discrimination. A faultily produced sound or word may sound correct for lack of fine auditory discrimination. In cognitive learning errors are even more difficult to perceive. Improvement in any skill proceeds faster with knowledge of results. The merit of rewards and punishment in many situations rests more upon the information they yield than upon the affective reactions of the learner. Bernard and Gilbert[10] comment on the fact that wrong responses (errors in maze learning by college students) which resulted in an electric shock were eliminated more readily than error responses which went unshocked:

> From the evidence available it seems reasonable to postulate that any well-defined stimulus introduced consistently in connection with either right or wrong responses will tend to favor their repetition if they are right or their elimination if they are wrong, provided that the stimulus is not of such a type or strength as to introduce a distracting effect. In other words, any stimulus which is not highly distracting may act either as a "punishment" or a "reward" depending upon whether it accompanies responses which are arbitrarily designated as right or wrong. . . .
>
> In human subjects, knowledge of a "punishment" stimulus appears to mean much more than direct affective reactions to the stimulus. In the present investigation most of the subjects reported that they tried to avoid the shock mainly because it signified error rather than because it was disagreeable. . . . Shock which was given in the "shock" alleys announced the errors in a definite and clean-cut manner and enabled the subject to make the location more accurately.

Criticism of performance has the essential purpose of pointing out error in order to permit correction. It serves this purpose if it is specific, constructive, and encouraging. There is little purpose in advising a student that his sentence construction or grammatical usage is faulty. This may designate the general kind of difficulty, but lacking specific information on kind of error, the necessary steps to improvement remain unknown to the writer. In the same manner, vague admonitions to "try to do better" aren't helpful unless the learner is aware of what steps be can take.

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[10] J. Bernard, and R. Gilbert, "The Specificity of The Effect of Shock for Error in Maze Learning with Human Subjects," *Journal of Experimental Psychology*, 28 (1941), pp. 184-85.

In experimental studies, where learners have been informed systematically of wrong responses and compared with another group systematically informed of correct responses, the learning rate of the latter group surpassed that of the former. There is greater advantage in knowing what *to* do than in knowing what *not* to do in any situation affording a choice between more than two alternatives.

Positive criticism has the additional advantage of minimizing such affective reactions as discouragement and frustration. Self-evaluation has the added advantage of avoiding the interpersonal resentments that external criticism can create, as well as aiding the development of individual standards of appraisal and initiative and encouraging their application.

A simple step toward that end available to all teachers is reduction of the emphasis on measurement incorporated in quiz and test sessions, and prompt return of results. Various procedures for having individuals or groups correct their own papers and evaluate their own errors are available. Through self-correction of examinations and group tabulation of the frequency of errors to each question, points needing further instruction can be identified. For example, workbooks are commonly used in many learning situations, from elementary school through college. Too often they serve as busywork, timefillers to occupy one group of children while the teacher is busy with another. The group could be provided answer keys. Tabulation and correction of their errors provides them prompt knowledge of both individual and group weaknesses, suggesting points at which additional work or review is necessary. The same procedure applies to tests. Students could correct their own tests from answers provided by the instructor, thus avoiding the time lag which commonly occurs between taking the test and learning the results and permitting immediate correction of error. Knowledge of results is as valuable as reward and goal setting in its contribution to performance. Helmstadter and Ellis[11] compared three different goal-setting procedures—a self-set goal, an externally established goal, and a goal of improvement with immediate knowledge of results—each procedure being followed in one group on a manual dexterity task. They found that all groups showed similar performance curves.

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[11] G. C. Helmstadter, and D. S. Ellis, "Rate of Manipulative Learning as a Function of Goal Setting Techniques," *Journal of Experimental Psychology*, 43 (1952), pp. 43, 125-128.

Inevitably certain students will alter incorrect responses to correct ones, especially where they anticipate the score will be part of a grade. This practice disappears as they become accustomed to the use of the test purely for analysis, and where they understand its contribution to self-improvement.

Recitation. In spite of open criticism of it as the unimaginative teacher's procedure, the practice of assign-study-recite-test is still very evident. Many classes at the secondary level are little more than a recitation of assignments given in the last five minutes of the preceding session punctuated at intervals by quizzes and examinations. Research fails to support this procedure as an effective method of teaching for even so limited an objective as the learning of factual information. Such an arrangement fails on several counts: little or no provision for individual differences in capacity, independent work, and motivation; inadequate directions on how to proceed; no provision for checking progress during the course of carrying out the assignment; inadequate review of the teacher. In the usual form of recitation in which students take turns responding to questions placed by the teacher, the students quickly identify the way in which teachers call upon students—alphabetically, seating plan, whatever her scheme—and adapt to it by studying those parts of a given assignment on which they are likely to have to recite. A random order for calling on pupils may foil them, but it still fails to give each pupil more than a fraction of the recitation needed, and fails to identify the points of difficulty being experienced by each pupil.

The criticisms directed against recitation are not that it lacks value but that it is misused. Recitation is a form of review, hence it is best preceded by learning. There is ample evidence to show that recitation fosters or reinforces learning when:

1. It provides progressive knowledge of results.
2. It permits better distribution of practice by pointing out parts on which additional practice is needed.
3. It promotes recall in a way in which the material will characteristically be used.
4. It contributes to meaningfulness of material.

5. It serves as an incentive by providing confirmation of progress in improvement.

Basically, recitation is valuable to the degree to which it is individualized and makes the materials learned functional. A number of plans have been developed and tried during the last three decades in the attempt to attain these ends. The Winnetka and Dalton Plans, project and activity methods, and teacher-pupil planning and cooperative group activities were developed and used in efforts to provide more pupil-centered, individualized instruction. Two current designs in the effort to provide for differentiated instruction and individual rates of progress are team-learning and team-teaching. Both depend on adequately developed and diversified materials, appropriate grouping of children, and periodic check-tests that permit children to work, learn, recite, review, and check one another on their progress, all done under the supervision of the teaching staff. Team learning is particularly adapted to the one teacher-one class organization, and is especially useful with such subjects as arithmetic and spelling. Small groups of pupils are provided graded assignments on which each works, then compares results with his fellows for agreement. Where disagreement occurs, the pupils check on their errors; if help is needed they turn to the teacher. Periodic quizzes provide a check on knowledge and understanding prior to the introduction of new materials. It can be seen that the teacher's role is here quite different from the traditional assign-review role. She is engaged in the development of materials, introduction of concepts, provision of guidance at points of difficulty, review of progress, and analysis of error. She hears very little formal recitation. Yet the procedure provides more opportunity for pupil recitation through mutual instruction and correction as an integral part of the learning.

Team-teaching is a more complex organizational arrangement whereby a group of teachers pool their resources in order to instruct a group of classes. In its simplest form in the elementary school it is similar to departmentalized teaching in the secondary school, except that teachers move to pupils rather than vice versa, and only one teacher has primary responsibility for a given class. The Detroit Plan is a system-wide variant of this in which specialists in music, art, physical education, and so forth and teachers are alternated between groups on a scheduled basis. In a more highly developed form, team-teaching utilizes a range of graded materials, a variety of learning and recitation devices such as audio-visual devices, teaching machines, projects, and review tests. A highly organized division of labor between teachers permits scheduled contact with individual pupils, small groups, and large groups. The basic attempt is to adapt materials and teaching skills to individual pupil needs and rates of learning.

Both procedures use review tests for regular checks of progress. The emphasis is on degree of mastery of given material rather than on measurement of comparative standing for purposes of grading. Tiedeman [12] advocates the use of review tests immediately after learning and at periodic intervals subsequently. He found more forgetting in one day when retention was not aided by review than was forgotten in 63 days when two intervening review tests were used as aids to retention. By incorporating such review procedures in team-learning situations, a form of recitation is provided all students on all materials. This can be especially beneficial to pupils of below-average ability in whom forgetting is rapid.

Incentive conditions. "Motives" are defined as existing within the individual and directing his energies toward certain goals. Though events shape them and conditions may be created which utilize them, they are part of the internal environment of the individual. Those parts of the external environment, those objects or situations which are capable of satisfying a motive are designated "incentives." In any learning situation multiple incentives are usually involved. The student preparing a project for a science fair is usually working on a project which he finds satisfying in its own right, yet he nonetheless hopes that he will win one of the awards. He finds himself under pressure from the science teacher, who wants his students to reflect a good image of him to his colleagues and the community. The student is reluctant to not engage in an activity in which most or all of his fellow classmates are engaged; yet he has some fears about being left behind in the competition. He enjoys the sense of accomplishment he feels when he completes the project and has it ready for the fair. Certain of these conditions provide an *intrinsic* satisfaction in that they are a functional part or consequence of the activity. Certain others have no basic relationship. A large portion of our lives is spent in study and work—it would be ideal if we could enjoy these activities for their own sake. Hopefully, the student's main satisfaction in preparation for the science fair would be the enjoyment from a successful project rather than the award or prize to be won. Studying, working, learning, producing should be satisfying in and of themselves. There should be no need for prizes, rewards, winning a competition, honor rolls, and *magna cum laude* degrees, artificial incentives that too often have the unfortunate effect of developing a "what's it worth" or "what's in it for me" attitude. Individual motivation being what it is, the world of work and the inept matching of men and jobs being what they are, nonfunctional incentives will exist for some time, if not forever. Yet our use of incentives can be subordinated to the intrinsic satisfactions to be found in achievement, so well characterized in Mallory's explanation of why he tried to climb Mt. Everest: "Because it's there." This is much the same motivation that prompts the exploration of space.

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[12] H. R. Tiedeman, "A Study of Retention of Classroom Learning," *Journal of Educational Research,* 41 (1947), pp. 516-30.

The decision to be made is not whether or not to use incentives, but how and when to use them and to what educational purpose. Incentives have their value and their place. They encourage effort, particularly in early stages of learning when intrinsic satisfactions are low, and they provide knowledge of results. But, unhappily, they become ends in themselves as a result of overdependence on them.

We overlook more basic motivational conditions in any learning situation and we neglect the effects of our incentive conditions on the developing motives of children in our desires to spur short-term pupil effort for immediate learning. We are so habituated to marking and grading, rewarding and punishing, testing and measuring that we think the entire learning enterprise would end abruptly were we to dispense with them. To not use them is to fail as educators. The intrenchment of this concept in educational thinking was observed recently in conjunction with a project of the Massachusetts Council for Public Schools for providing foreign language instruction via television—"Parlons Français"—to the 150 school systems participating in The 21″ Classroom's in-school television broadcasts. Two fifteen-minute programs per week are provided children in the intermediate grades, to which are added two correlative fifteen-minute practice sessions by the classroom teacher. Where administrative support and teacher enthusiasm is high, the children show considerable progress in learning to speak French. The learning that occurs is self-evident and is further corroborated by end-of-year tests. The teachers were encouraged not to concern themselves with grading or evaluation, in the knowledge that the direct satisfaction of learning to speak a foreign language would be satisfying and motivating to the children.

One need not administer tests to determine if an instructional program in foreign language is going well. If the only time the children make use of the second language is during the practice sessions, if they make no spontaneous use of it, if they cannot respond to simple questions or directions, they are not learning the language. If the teacher does most of the talking during practice sessions, the children speak haltingly or not at all, and the practice consists mainly of games, songs, and mimicking, the instructional program is inadequate. Yet such observational evidence did not satisfy many administrators and teachers. They believed that if they didn't test and didn't grade, the instructional program wasn't educationally respectable. They gauged their effectiveness by the procedures being used rather than by the performance of the children and the satisfactions found in learning and mastering a second language.

Incentive conditions are only one of many factors affecting the motivational climate of a classroom. When young children enter school their needs for the approval of adults, and for the maintenance and development of their self-esteem are quite strong. Their approach to school is a mixture of obedience, curiosity, fear, anticipation, and uncertainty. Gradually, if conditions are favorable, they develop desires to master the tasks which confront them and acquire confidence that they can do so. They also develop an awareness of the emerging peer group and a desire for a place in it and approval from it. Research increasingly supports the principle that the learning that occurs in any classroom is functionally related to the kind of personal relationship existing between a teacher and her pupils and between pupils. One's basic needs for self-esteem, recognition, and acceptance find their satisfaction in this matrix of interpersonal relationships. Compared with the forces of self-acceptance, teacher-acceptance, and group acceptance, the specific incentive conditions created by the teacher are of secondary importance. In part their effectiveness depends on what they signify about the teacher-pupil relationship. If the incentive conditions are low-pressure, work-centered, and related to information about progress they are useful, but if they are high-pressure, personal, and competitive, they are partially self-defeating—they will be effective only with those few children who can and will respond to such conditions. In this context, incentives become part of a total setting affecting motivation, and the research on the specifics of incentive conditions is more meaningful.

Rewards and Punishment

Reward is one of the foundation-stones of learning. Hedonistic explanations of learning have a long history culminating in Thorndike's law of effect and Hull's theory of primary and secondary reinforcement which, in substance, say that satisfying outcomes reinforce the behavior which leads to the reward because of the reduction in drive which the reward provides. Whether the explanation lies in the reduction of drive, in a change in the stimulus conditions associated with the termination of behavior, or in an increment to the probability of a repetition of the behavior as the more sophisticated applications of modern statistical learning theory suggests (Estes [13]), reward and reinforcement have both a theoretical and practical role in learning. Regardless of theoretical explanation, it is essential that reward be linked with the kind of behavior desired. If quality of work is important, then that is what has to be rewarded—not punctuality, attitude, or some other characteristic. The specificity indicated regarding the effect of rewards lends support to our discussion of the general motivational conditions (pp. 31f). This is illustrated in the manner in which students vary their preparation for an examination in terms of the type of examination being given. Here the student adopts the study technique most likely to yield the favorable mark contingent upon high examination score. The variety of ways in which satisfaction of the interpersonal motives (*i.e.*, motives for which satisfaction is contingent upon favorable response by another person) of desire for recognition, approval, and acceptance can be provided in the elementary and secondary schools offers the teacher a range of procedures varying from smiles to grades.

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[13] W. K. Estes, "The Statistical Approach to Learning Theory," in *Psychology, A Study of Science*, ed. S. Koch (New York: McGraw-Hill Book Company, 1959), pp. 380-491.

Punishment, except in a two-choice situation has the effect of saying "stop what you did" without informing what should have been done. Used as a means of eliminating undesirable behavior, it is likely to have the effect of only suppressing such behavior without reducing the strength of the drive that gave rise to it. If undesirable behavior is to be stopped, appropriate alternative behavior must be taught and allowed to replace it. Punishment has the additional disadvantages of creating interpersonal antagonism between teacher and learner, causing emotional stress which hampers learning efficiency, and the risk of fixing undesirable behavior. Praise, reproof, ridicule, and sarcasm operate similarly. Reward linked with competition often has the effect of reinforcing the wrong outcomes. Instead of behavior appropriate to the learning task being reinforced, the effect is to reinforce a desire to defeat one's opponent. While such motivation may be desirable in professional athletes, there are many problems faced by society which have greater need of cooperative effort by participants.

In looking at the effects of incentive conditions in shaping behavior, consideration must be given to not only the immediate outcomes but also to long-term effects on developing motives of children. In laboratory experiments it is possible to arrange incentive conditions so that physiological drives are being manipulated, but rarely are these primary drives operative in classrooms—instead, a complex system of acquired social motives is being met. Incentive conditions within the classroom should be such that not only are the motives harnessed to the task of learning, but that the way in which they are used shapes them to individually and socially desirable ends.

Two unfortunate effects of mismanagement are dropouts and cheating. When reward conditions are such that only a few can attain them, as is the case with A's and Honor Rolls, a major fraction of the students are denied the sense of accomplishment signified by "good grades." These students develop a progressive sense of failure, seeing little purpose in striving for a relatively unattainable goal.

The result is lower motivation, a contributing condition to a major portion of the dropouts. It would surprise no teacher to know that in a group of adults asked to run three blocks for a prize of $10, few would start and most of them not finish. Only those who thought they had a chance to win would finish, plus a few who completed as a matter of personal pride. Yet we somehow expect children to persist in the face of continued failure made the more painful for being public.

A second advantage of such incentive conditions is that grades, honor rolls, and similar symbolic rewards become ends in themselves, often to be gained at any price, including cheating. When 20-80 per cent of pupils in grades 2-6 (twenty classes) change answers during self-correction of quizzes (Toporowski [14]), the effects of the desires for "good grades" can be seen.

Success and Failure. Many of the disadvantages of artificial incentives can be avoided by emphasizing individual and group goal-setting and evaluation based on success in making progress towards and achieving the goal. Few teachers will deny that pupils are incapable of learning more than they are; if anything, teachers are concerned more with lack of motivation in and effort by their pupils. Placing the emphasis upon goals which are realistically set would provide all with the feeling of accomplishment derived from making progress and reaching the goal. Teachers should place greater emphasis on progress instead of excellence of scholarship. Success would be available to all within an organizational scheme in which failure and discouragement are not too high nor success too easy. A sense of progress and accomplishment encourages feelings of adequacy, independence, and initiative; it maintains or increases motivation, lowers hostility and aggression stemming from frustration, and contributes to positive mental health.

General Principles

In conclusion, we may state a number of general principles that emerge from the experiments with teaching procedures.

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[14] Dolores Toporowski. "Opinions of Elementary School Teachers and Students Concerning Correction of Papers" (Unpublished M.Ed. thesis presented at Boston University, 1958).

1. *Establish a predisposition to learn.*

If the learner sees purpose in what he is learning and has some knowledge of the value of the task, he will pay attention and learn more. Attitude is a generalized set. Lack of confidence, dislike of school or teacher, and failure to find value in assignments unfavorably affect children's efforts to learn.

2. *Clarify the task; define the problem.*

The learning situation should be such that unnecessary errors are avoided. Errors which contribute to knowledge of results may help, but those which result from confusion only produce more confusion.

3. *Provide a model, a demonstration, verbal guidance, and cues.*

A demonstration of the skill provides a model to be simulated; verbal guidance and cues help the learner direct his efforts by informing him of what to do and how to do it.

4. *Allow adequate time and distribute practice.*

Spaced practice with rest periods facilitates learning. Short initial periods which are gradually lengthened as skill develops are desirable. The early phases of practice periods are more effective inasmuch as efficiency decreases as fatigue and boredom increase. Mass practice to attain peak performance.

5. *Practice the task as a whole if it is simple or short; break complex tasks into natural components.*

Children tend to learn better by the part method; adults by the whole method if they have had some experience with it. In the whole method, progress is not readily apparent, a factor which can be discouraging to young children. Complete mastery of each part is not needed before introducing the sequential part.

6. *Insure accurate or correct initial responses.*

Avoid errors as far as possible and check them on their first appearance, unless to do so inhibits the motivation or effort of the learner.

7. *Encourage meaningful associations.*

Associations within the material encourage the development of an internal organization. Learning is facilitated by a contextual organization. Transfer of training from previous experiences is desirable.

8. *Provide for recall and recitation.*

Meaningful recall in any degree is conducive to favorable attitudes, contributes to meaningful learning, and allows for more effective distribution of practice. Too-early recall however leads to guessing and retards learning.

9. *Provide immediate knowledge of results.*
Accurate information as to progress is as valuable as reward in promoting learning. Delayed knowledge of results—examinations returned a week later—is not as helpful.

10. *Overlearn once mastery is attained.*
Retention is increased, positive transfer of training promoted, and interference with other learning reduced by any degree of overlearning. Drill should be meaningful, be similar to the situation in which the skill is to be used, and should command the attention of of the student.

11. *Reward liberally and early.*
Rewards reinforce behavior. They are best when they are an intrinsic part of the activity. Artificial incentives are useful in maintaining effort until some sense of achievement and mastery evolves.

12. *Apply the skill or learning.*
Have children make use of what they learn in order to foster retention and produce transfer of training.

13. *Help the learner to analyze his performance.*
Realistic appraisal and critical analysis are importantly related outcomes of learning.

CHAPTER V

The Teacher, Teaching Machines, and Transfer

The focus in the preceding chapters has been on the variables which affect learning. They have been treated singly, in most instances without reference to learner, task, or teacher, and as subjects of inquiry for which certain experimental and empirical data existed from which a set of generalizations could be drawn. The psychology of learning is concerned with the "how" of teaching and learning. It is intermediate between the social value system, which establishes the educational objectives of the community, and the teacher in the classroom, concerned with a specfic group of children. As useful as the generalizations are, they have limitations that are immediately apparent when one begins to work with an individual child or a class, for here decisions have to be made as to what to do when. The art of teaching lies in the ability to translate generalizations into action, and especially in recognizing where they do not apply.

In the school and classroom a number of sociological and psychological factors are operating to create special conditions which influence the course of events:

1. Each child presents a unique combination of abilities, traits, attitudes, experiences, and interests. Ideally, learning tasks and teaching procedures would be varied to suit each child. Possible in a tutorial situation, it is not in the group situation. However, considerable accommodation is necessary and possible.

2. Each child is a member of a series of social groups which direct and control his actions. His primary group is his family which creates his basic character. The family participates in a given social class, ethnic, and religious milieu which set values, norms of behavior, social and personal attitudes on a variety of subjects: attitudes towards school, expression of aggression, level of aspiration, sexual behavior, work, time, nature of man, and others. Most children participate in neighborhood play groups and friendship groups which develop their own goals, value systems, and interests, and

which influence children's behavior as long as they desire to maintain membership in the group.

3. The school is a social unit with a given mission and a prescribed field of action. The hierarchy of community values and the control of the school board establish permissible areas of action and prohibit others. For example, the freedom to discuss religion, sex, community politics, family budgets, and the like is usually quite restricted. It is much safer to discuss segregation in South Africa than in the United States; and if the latter, it is better to discuss some other region of the country in preference to one's own community. In addition expectations are established for the teachers, in part by the community and to a considerable degree by the school administration. A school acquires its own "personality," which is related to the principal's attitudes and expectations. There are quiet schools, active schools, confused schools, rigid schools. The teachers themselves constitute an "in-group" that demands conformity and support in conflict.

4. Within this framework, each class exists as a separate unit with its own operating procedure, its own social climate, its own interplay between students and teacher.

Children are reared in a man-made environment, consisting not only of the physical objects and tools which man has created and invented, but also the language, customs, skills, attitudes, and beliefs which he has devised and transmitted from generation to generation. Large-scale differences can be distinguished between recognizable cultural groups in different regions of the world. Although such differences are of no immediate concern to the teacher, their existence is mute testimony to the importance of cultural and social factors in shaping the behavior of members of a given society, and of the need for awareness of the patterns adopted by a particular group. Many so-called subcultures exist within this country—some identified with minority groups, some with urban-rural differences, some with socioeconomic differences. The differences associated with these subgroups have important implications for the classroom teacher. Prolonged economic and social deprivation and isolation has been shown to have negative effects upon intelligence test performance.[1] The quality and amount of formal schooling shows considerable variation by such subgroups; the differences have been particularly conspicuous in connection with social class and ethnic minority groups and, to a lesser extent, urban-rural differences. The quality of educational service available and economic factors undoubtedly contribute, but attitudinal differences and motivational factors associated with these varying subgroups play an important role.[2]

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[1] Anne Anastasi, *Differential Psychology* (New York: The Macmillan Company, 1958), Chap. 15.

Group differences associated with cultural variation have limited significance for the teacher working with a particular child, inasmuch as the differences within any such group are larger than the differences between subgroups within a culture. The teacher must meet the particular combination of aptitudes, personalities, attitudes, and behaviors present in a given child. The fact that a particular child is from a lower class family does not establish that his attitudes toward school will be negative. However, the tasks faced by a teacher extend beyond working with individual children, for most of her work with them is in groups. Yet the common attitudes brought by the children from the out-of-school environment establish in part the environment within the classroom; they prevail unless they are modified by in-school experiences. A number of studies substantiate the importance of such influences. Milner,[3] analyzing data from parent-child interviews, suggests that the relationship she observed among social status index, reading readiness, and linguistic development of first grade children may be explained by the more positive family atmosphere enjoyed by middle class children. Not only did these children have more opportunities for verbal interaction with adults, they also developed the motivation essential to success in adult-directed learning. Several studies have shown the significance of socializing techniques on achievement-oriented behavior. The interaction of parent approval-disapproval and success-failure in studies by Child,[4] Keister,[5] and Wolf[6] affects the achievement and persistence of children. In these studies, high levels of persistence were associated with demand levels properly adjusted to the level of children's ability, low persistence with insufficient or unreasonable demands, and also with social approval of persistent striving for achievement and disapproval of its absence.

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[2] A. B. Hollingshead, *Elmtown's Youth: The Impact of Social Class on Adolescents* (New York: John Wiley & Sons, 1949).

[3] Esther Milner, "A Study of The Relationships Between Reading Readiness in Grade One School Children and Patterns of Parent-Child Interaction," *Child Development*, 22 (1951), pp. 95-112.

[4] I. L. Child, "Children's Preferences for Goals Easy or Difficult to Attain," *Psychology Monograph*, 60:4 (1946).

[5] Mary Keister, "The Behavior of Young Children in Failure," *University of Iowa Study in Child Welfare*, 14 (1937), pp. 27-82.

[6] Theta Wolf, "The Effect of Praise and Competition on The Persisting Behavior of Kindergarten Children," *University of Minnesota Institute Child Welfare Monograph Series*, No. 15 (1938).

Although the home is the primary socializing agency defining the child's status in society and interpreting his experiences for him, the teacher is the formal agent of society. Her task goes beyond the transmission of knowledge and skill, and includes developing and shaping attitudes, motives, and values. Her effectiveness in this role is dependent upon her ability to function as a group leader. Each child enters school with a unique biological, psychological, and social heritage evidenced in his aptitudes, personality, and behavior patterns. His entrance into school marks a psychological and social separation from the home. Prior to his entrance to school, his group membership has been limited to the home—now he is on the verge of friendships which will expand to membership in a group of peers. The developments that occur in his attitudes, motives, and values will be determined to a large extent by his membership and roles in the groups in which he comes to participate. The extent to which the school is a major factor in shaping them will depend on the ability of teachers to shape and influence groups of children and their attitudes. A study by McCandless [7] illustrates the difference that the kind of direction provided can have on acceptability and status within a group. McCandless predicted and observed that, under autocratic adult leadership, adolescent boys in a training school would admire the openly dominant boy "because he dares to react in the fashion which all boys would . . . were it not for the fear of punishment or failure involved." When the leadership in an experimental cottage was changed from adult-dominated to a form of greater self-government, the correlation between dominance (determined by ratings by adult supervisors) and sociometric popularity dropped; indeed, the popularity of the six boys originally rated least dominant increased. In contrast, the correlation increased in the control group during the eight months of the study, reflecting not only the stability of group structure once established but also the influence of the adult directors on its nature.

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[7] B. R. McCandless, "Changing Relationships Between Dominance and Social Acceptability During Group Democratization," *American Journal of Orthopsychiatry*, 12 (1942), pp. 529-535.

Eight dimensions of the instructional group require consideration. Three are relatively inflexible, the remaining five flexible, in point of teacher modifiability:

Inflexible

Major goals
Leadership—authority
Group membership

Flexible

Climate—atmosphere
Interaction
Communication
Structure
Norms

The major goals of the instructional group are determined by school board policy, curriculum, and the teaching materials available. Within this framework, subordinate goals, such as projects or activities, may be determined by the group, but the range of freedom is relatively narrow. The teacher is established as leader, and the amount of authority she can share with or delegate to members of the class is not great. Students are required by law to be in attendance; rarely do they have any choice of school, teacher, or fellow classmates.

The remaining elements are susceptible to teacher influence, and the more so the younger the pupils. Whenever individuals—children or adults—form a group, consensus rises quickly as to who is and who is not accepted, who is perceived as expert, who is not, who has power to get his way, who does not, and as to the status of each individual. These rapidly formed positions remain stable over time in spite of an individual's efforts to improve or modify their acceptability, power, or status. The teacher is in a key position to influence the development and functioning of groups. She has the power to determine the patterns of interaction. These may be restricted to teacher-pupil interaction denying students access to each other, at least in the classroom; or they may range to spontaneous, student-determined interaction. In most classrooms interaction is regulated by the teacher, both as to frequency and type; *e.g.*, whether or not it shall be competitive or cooperative. The teacher is determiner of the rate of student output and the direction, pattern, and spread of the communication network. She plays a central role in establishing the norm system, the set of shared expectations regarding appropriate behavior, and the extent to which the students will share in determining it.

The particular group structure that emerges in any class results from the interplay of many forces—the differences in ability and motivation of the members of the group and the individual needs of the teacher set in a matrix of social forces. Figure 5.1 diagrams these —the professional and community forces bearing on the school, the formal administrative responsibility, the expectations established and shared by the faculty, the individual students, and the emerging and progressively more important peer group, which establishes its own social structure and norm system. In the figure an attempt has been made to indicate variations in the teacher's role—the teacher functioning now as a group member, now aloof from the group, now detached and dominant—suggesting differences in the group climate being created. The climate created by the teacher determines common modes of response adopted by the students towards each other,

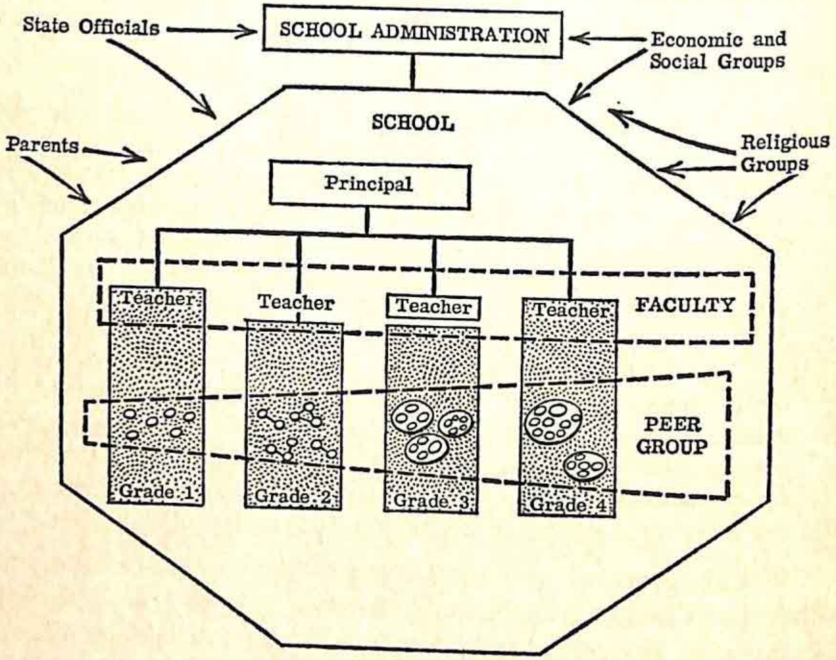

Figure 5-1. Social pressures affecting the teacher.

towards authority, and towards learning. She determines whether it is supportive—encouraging mutual listening, harmonizing, and problem solving—or defensive—characterized by advice-giving, blaming, controlling, persuading, and punishing. She encourages or inhibits the initiation and testing of ideas, the regulation and control of actions, the acquisition and evaluation of information, and courses of action. Every teacher creates a unique climate in her classroom, the result of her own personality as it is affected by the matrix of forces in which she finds herself. A number of brief descriptions illustrate some of these differences:

1. A teacher so lacking in emotional spontaneity and expression that the children never laughed or smiled in class.
2. A teacher whose skill in group work results in a continuous workshop atmosphere with groups of students working independently on projects using her as consultant and arbiter of conflict.
3. A teacher whose bent for sarcasm seems quite humorous until every student becomes the target. The outcome—a group which claws each other with fault-finding.
4. A teacher who relates herself to the students individually rather than as a group, and who uses the interplay between her encouragement and individual relationship to create high rivalry between pupils and generally high achievement in the competition for her favor, but with several students each year developing severe situational adjustment problems in their inability to keep pace.

There are probably as many variations as there are teachers, but withal the climate which a teacher creates and the roles she plays are essential determinants of class behavior, development, and achievement. She is an emotional thermostat playing a dominant emotional role in the class; she is organizer and director of activities; she is sanctioner and approver of behavior. The emotional climate she creates is determined by her personality and by her motives in teaching, for the latter determine the points at which frustration will occur. Her motives for becoming a teacher are numerous and varied: family pressures, interest in a particular field of knowledge, desire for status, love of children, identification with a former teacher, desire for security, desire to contribute to improvement of society, inadequacy in working with adults, satisfactions of needs for dominance, or some combination of these. The degree to which her needs are satisfied or thwarted and events in her life situation—financial problems, illness, family conflict, failure to marry—determine the stresses and satisfactions she experiences and which contribute to her emotional capacities relative to children.

Figure 5.2 indicates three aspects of the classroom situation affecting climate and morale. Within any group situation there are

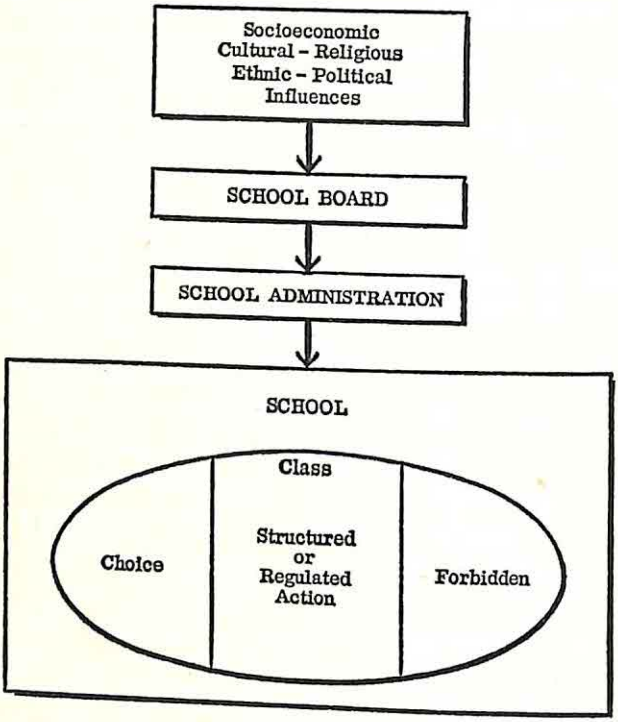

Figure 5-2. Diagram of sociopsychological factors influencing class.

kinds of behavior that are prohibited or forbidden; there are kinds of behavior which are subject to rules and regulations; there are kinds of behavior which are open to choice. In our society, certain kinds of sexual behavior, aggression, and treason are forbidden; taxes, automobiles, and burials are regulated; food and clothing preferences and child-rearing practices are subject to individual volition. The classroom is similar in its operations. A suitable atmosphere exists when a balance of the three modes of behavior and avenues for the satisfaction of human motives, rather than their denial is achieved. A classroom in which there is no room for choice may be efficient and achievement high, but it is not healthy. Instead, it is like a prison, for all behavior is regulated—what you do, when you do it, who you do it with, when you eat, when you can talk, what you can talk about, when you come and go, and so on. This is scarcely prepartion for living in today's world with its interminable choices.

A teacher can very easily check her performance by asking herself, at the end of the day or a week, "At what points and on what subjects did the students have any freedom of choice?" That freedom will have been rare, perhaps nonexistent. Usually a teacher continually imposes her purposes on her class, instead of relating her purposes to student needs, motives, and interests.

The area of regulated behavior may be established by teacher dictum or it may be achieved through shared authority. The process of creating rules and regulations is a valuable learning experience in itself, for through it children develop standards of their own creation for evaluating their performance. Hopefully, it would not be done as an abstract exercise in the promulgation of rules, but done piecemeal, as need arises. One of the purposes of regulations is to provide a system for getting necessary work done in complex social situations; another is to prevent difficulties by setting bounds to behavior. Greater flexibility should exist in the classroom. It is possible to prevent difficulties by preestablished rules and regulations, but such an arrangement can work to deny children important learning experiences.

Perhaps an illustration can be taken from administration. Many times an administrator bemoans the problems he is faced with and wishes there would come an end to them. Regardless of how we might sympathize with his plight, we should recognize that finding solutions to problems is the *raison d'être* of an administrator. A teacher in her classroom is in an analogous situation. Her goal should not be an environment in which no problems occur, but rather one in which their occurrence provides an experience resulting in learning—of moral standards, ways of treating one another, concerted action to achieve common goals, and so on. Rules are better if they evolve as expressions of developing concepts rather than preordained determiners of behavior.

The kinds of action and behavior which are prohibited should be those which not only are socially taboo but also those which foster destructive or harmful behavior. Too often the prohibitions do the opposite—deny the expression of healthy, constructive motives. For instance, a cafeteria in which talk is forbidden denies children healthy, natural intercourse. If conversation interferes with the cafeteria regimen, there are alternate or compromise solutions. A junior high school with a regulation that students must walk single-file when passing from class to class is absurd. It merely indicates that the administration is unwilling or incompetent to meet whatever problems exist educationally.

Within this context, the teacher has many roles to play. The ones she selects will depend on her concept of herself, her motives, the student's conception of a teacher, and administrative and community expectations of her. The teacher can serve as:

1. Representative of society imposing social demands.
2. Source of knowledge and information.
3. Guide or helper in learning.
4. Referee or arbiter of disagreements.
5. Evaluator and judge of performance.
6. Detective of forbidden behavior.
7. Object of identification.
8. Reducer of anxiety.
9. Ego supporter.
10. Group leader.
11. Parent substitute.
12. Individual friend and confidante.
13. Object of affection.
14. Target of hostility.
15. Tyrannical overseer.
16. Administrative agent or clerk.
17. Protector and defender.

Some of the roles are forced upon unwilling teachers, but within the range of choice open, the roles which stimulate children towards more appropriate kinds of behavior are: (1) the source of knowledge—the experienced person who guides, helps, and assists with explanations and suggestions; (2) the standard-setter who evaluates performance and establishes limits and bounds; (3) the referee who mediates conflicts and reconciles differences; (4) the ego supporter whose encouragement and support can be depended on; (5) guide, helper, and counselor who encourages the development of self-understanding; and (6) the friend, confidante, and member of the group who shares feelings and experiences.

Equally significant in the modification of behavior is the influence of one's classmates, exercised informally but influentially to the degree to which group structure and group membership exists. As individuals establish interpersonal relationships, a group structure emerges in which different roles and status are assigned to various members and a set of group norms is established. The group norms are shared because of the potential gratifications deriving from doing so and fear of the penalties for not. It is difficult to determine the degree of sharing or the result of conflicts in norms resulting from membership in different groups. The group is a vehicle through which change in individual attitudes can be achieved and is, to some degree, susceptible to teacher direction. Comparing the individual and group motives in play in a classroom situation shows a number of significant motives which are group-oriented:

Group

Group loyalty
Gaining status or attention from group
Competition
Power
Gaining acceptance
Friendly interplay
Affiliation with group

Individual

Supporting or resisting authority
Gaining status or attention from teacher
Achieving standards of performance
Work for rewards
Work to avoid anxiety
Intrinsic interest in work
Self-esteem

Within this milieu of motivation, a teacher can bring about behavioral change if she can so structure a situation that a higher order of satisfaction will be derived from a change of behavior than from maintenance of the current behavior. The increment in degree of satisfaction has to be sufficient to overcome established habit patterns. Involved here is a creation or selection of reinforcement conditions to bring about change. This includes the agent of reinforcement—teacher, class, work; the object of reinforcement—individual or group behavior; the nature of the reinforcements—rewards, punishment, whatever; the appropriateness of the reinforcement—as it is task or person-oriented, and as it is a natural stimulus or consequence; and the schedule of reinforcement—the frequency and conditions under which it occurs. Although this may sound unnecessarily complicated, an illustration will be of value:

> When a sociogram was made in an eighth grade class, it revealed that Jean was an isolate. This didn't surprise the teacher because whenever she would divide the class into groups for work, Jean inevitably started an argument about how to divide the work, and ended by stalking away to sulk. The teacher was conscious of two other difficulties: one a reticence in reciting, the second, a difficulty in accepting an appropriate feminine role.
>
> Jean was an attractive girl by adolescent standards, healthy and energetic. She came from a middle-class family in which both parents worked. She had two older brothers, one in the army, the other in high school. They played various sports together and Jean had become quite skilled. During recess period she was much sought after because she could hit and field a baseball as well as any of the boys. She scorned the idea of playing baseball with any of the girls, "because every run they made was on errors." The same boys who wanted her on their team ignored her on other occasions, however.
>
> She had high average intelligence and her achievement was at grade level. When called upon to recite in class, she'd straddle her desk, give a brief answer, and thump down into her seat. Asked to elaborate, she would respond, "I just told you." She usually dressed in stiffly starched boy's shirts, skirts, and saddle-type oxfords, using a boy's mackinaw or wool shirt for a jacket.
>
> In regrouping her class following the sociogram, the teacher grouped her with a highly feminine but very capable girl and a boy who was not only capable in both studies and sports but also very sociable. Both were highly chosen individuals on the sociogram.

The teacher was purposefully attempting to create a group in which Jean would find acceptance. Recognizing that the girl presented a group with difficulties, she selected two students capable of meeting the problem, students who could serve too as models of femininity and masculinity.

> At first the conversations flowed around Jean, but gradually she became involved in them. Since she was good at drawing, she was given the job of drawing a map of Grant's Mississippi Campaign, part of the social studies work. When the group came to report, they delegated Jean the job of giving a "chalk-talk" on the campaign, and when the class chose to use her map as a bulletin board display,

> she really beamed. Though she was becoming more expansive verbally and socially, she still scorned girls' activities. When the time came for the Christmas program and dance, Jean would have no part of it. When the girls came to the teacher saying that Jean wouldn't help with the decorations, the teacher utilized group pressure by suggesting they ask Jean to help make a fireplace out of orange crates (a masculine activity). When the girls asked Jean to do this, she told them to get the boys to do it, but decided to do it after the girls complained that the boys weren't responsible. Before she was finished, Jean took a group of the girls home to cover the crates with crepe paper she had at home, and they ended up making fudge and watching television.
>
> On the day of the party, Jean said she wasn't coming, but that night she brought in a cake her mother had made (the teacher had earlier discussed her plans with the mother). After bringing the cake, she started to leave, but the girls asked her to help with a decoration that had fallen (Jean was the steadiest person on a ladder). She started to leave again, but the teacher asked her to help serve. Ultimately she stayed, enjoyed playing charades, even though she didn't dance. That winter, the teacher got Jean to play on the girls' basketball team "to help the girls learn to shoot baskets like the boys."

Interplay of individual and group reinforcement is seen in the gradual modification of Jean's behavior, both personal and academic, almost in spite of herself.

The over-all education activity has to function in an analogous manner. The efforts of a second grade teacher to apply the principles of learning to a developmental-activity unit in science is described here. These are the principles and objectives she took into account:

1. Allow for individual difference in ability, need, interest.
2. Provide for physical, emotional, and social growth as well as mental growth. Such growth requires more than subject matter mastery and requires an expansion of subject matter rather than minimizing it.
3. Basic considerations: readiness, preparation, motivation, appropriate practice, drill, reinforcement through reward and success.
4. Conditions needed for learning: security—a sense of belonging in the class; confidence—the child feels equal to the task; effort—the child learns what he does; meaningful experience—encourage the child to question, observe, engage in activity; success.
5. Emphasize interest, meaningfulness, variety in presentation,

knowledge of progress; minimize contests and competition, rewards, punishments, and restrictions.

This particular unit got its impetus from a child who was reading Dr. Seuss's book *Horton Hears a Who*. She was enjoying the book so much that the teacher read it to the class during their story period. Taking advantage of the children's interest in the story about the elephant, the teacher asked the class if they would like to see an animal show. Getting an affirmative answer, she asked each to tell about some animal he had seen, an activity that carried over to the next day.

The teacher obtained from the school librarian all the available animal books on the first to third grade levels and arranged them according to the reading ability of the pupils. She scheduled a film on zoo animals, and also placed some colored animal pictures at the front of the room. This stimulated further discussion, and during the art period that day the children drew various animals which the teacher placed with the colored pictures. When the children explained their drawings, they began to ask questions about the various animals and turned to the teacher for information. She suggested books in the special section of the library appropriate to the children's reading level. Where available reading material was too difficult, the teacher suggested other animals, knowing what was available.

On the following day the film was available for story time. After the film, the children wanted to tell what they had learned, but the teacher suggested they take their books home and see how many interesting things they could discover. Asked if they would like to study animals, the class responded enthusiastically, but developed too long a list of animals, considering the long list of questions they had generated. They cut down the list, and the teacher divided the class into groups based on animals the children were interested in, and picked a leader for each group. Each group decided which of the questions they wished to answer (each group having two animals) and the form in which they would report their information. Thereafter, the unit took up all class periods except the basal reading and arithmetic drill period. Exhibits were put on display, and the endeavor ended with the presentation of a play to the school.

The objectives were achieved to a fairly high degree, and the pupils learned to work quietly together and to cooperate in locating information. They learned something about many animals, notably their values and their methods of protecting themselves and obtaining food. Most difficult to evaluate was the extent to which attitudes and appreciation of animals changed.

Objectives

Teacher	Pupil
Gather and organize material	Learn about different kinds of wild animals
Develop leadership and initiative	Learn about animal homes
Develop responsibility—in carrying out tasks; in caring for materials	Learn about how animals get their food and protect themselves

Development of unit

Selection of animals, committee assignments, and reporting:

1. Bear, elephant	Scrapbook	plus individual reports
2. Hippopotamus, monkey	Mural	
3. Whale, tiger	Clay models	
4. Lion, giraffe	Booklets	
5. Kangaroo, rhinoceros	Animal charades	

Committee functions:

Divide up and assign questions to be answered.
Decide how and where to obtain information.
Select procedure for reporting.

Questions developed by pupils:

How much does animal weigh?
How tall is he?
Are their teeth sharp?
Do they have fur or skin?
Do they make good pets?
Can they run fast?
Can they carry heavy loads?
Can they be trained?
What kind of feet do they have?
Do they have claws?
Do they keep their claws sharp?
Can they hear well?
Does he drink much water?
Do they lay eggs?
How do they find their babies?
Do they carry their babies?
How many babies do they have?
Where do they hide?
How do they protect themselves?
Where do they live?
How do they protect their babies?
Do they have winter homes?
Do you find them in a zoo?
Do you find them in a circus?
Are they friendly?
Are they dangerous?

Do they drink differently?
Do they run or jump?
Can they swim, climb trees?
Do sea animals sleep?
Can they see well?
How do they fight?
How long do they live?
Do they kill for food, or just because they like to?

Correlation with other subjects

Language arts:

- Reading widely used in gathering information.
- Writing used when children wrote short animal stories and letters of invitation to other classes.
- Oral language used by all pupils in reports, in discussion of zoos, circuses, experiences with animals.
- Children selected and learned to spell names of twenty animals.

Social studies and science (direct study more than correlation):

- Pupils learned the kinds of food used, how obtained, how animals protect themselves and the provision nature makes for protection. They learned about the size and appearance of the animals, and about their homes.
- Pupils learned what different countries the animals lived in.

Arithmetic:

- Comparison of height, weight, size.
- Problems involving size of animal families computed.
- Ages of animals compared.
- Some learning of four digit numbers required for weights of elephant, hippopotamus, rhinoceros, whale.
- Some learning of terms such as pound, tons, miles, yards, feet, inches, bushels.

Music:

- A variety of songs were learned: "Monkey Song," "See That Elephant," "Big Brown Bear," "Have You Seen the Zoo?" "Animal Talk," and others.

Health and safety:

- How animals are cared for in the zoo and circus.
- How the public is protected from dangerous animals at zoo and circus.
- What animals eat.

Art:

- Animals modeled from clay.
- Jungle of cardboard, construction paper, and clay animals.
- Freehand drawing and coloring of animals.

Stencils and freehand drawing used in making mural.
Spatter work used in making animal booklets.

Although only the barest outline of the unit has been presented and illustrated, the applications in an operational setting of the generalizations regarding learning are:

1. Begin where the learner is. This requires knowledge about the child's physical characteristics and health, capacities, personality, previous experiences, and level of achievement.
2. Adjust the pace of presentation to the learner. Flexible subgroupings are necessary in order to work with groups of children at common levels of achievement.
3. Select and introduce activities consistent with educational objectives in points of content, pupil activities, resources, and evaluation procedures. Execution requires alertness and flexibility rather than rigid schedules, appropriate feedback on progress, and periodic summary and evaluation. The activities selected and procedures followed should be linked to specific behavioral changes in doing, knowing, feeling.
4. Motivate by providing for learner satisfactions—directly from the intrinsic satisfaction from learning, indirectly through incentives, or concomitantly through satisfaction of security, status, friendship, and self-esteem needs.
5. Create a physical and emotional environment that contributes to healthy personal and social development as well as intellectual development. The interpersonal relationships of teacher and class, group processes, and disciplinary procedures used establishes the social climate.
6. Evaluate and redirect, using test and observation to determine degree to which objectives are being achieved and the kinds of modifications of plan which appear needed.

Television and Teaching Machines

Two major developments which have occurred in the past decade in educational technology are the use of television and teaching machines. Both enter education as auxiliary devices, with the promise of finding a permanent niche which may not be determined until the modifications which they are causing in traditional procedures are completed. The self-contained classroom—the egg crate organization in which groups of equal size are assigned to their respective teachers in uniformly equipped rooms—is yielding to a flexible organization in which groups of varying size work in different combinations with teachers. Television and the teaching machine fit into such a scheme. Television instruction is an attempt to provide simultaneous instruction to a large number of individuals. Teaching machines, in contrast, are an attempt to automate the tutorial process of individual student-teacher interaction—the machine is merely the device whereby an instructional program and a student interact. At the heart of the process is the program of instruction. This consists of subject matter presented in small, discrete steps; it is carefully organized in a logical sequence, through which the learner progresses at his own rate, with each of his responses confirmed or corrected immediately.

Two main types of programs have been designed—the linear program, and the branching or scrambled program. The former requires the learner to supply an answer by writing in a missing word or phrase, much in the form of the short-answer or completion-type item, except that in this situation the learner has little or no prior knowledge. Therefore the items are carefully constructed to minimize error in response through the use of contextual or semantic cues within the framework of the item. In the linear program each step is taken in sequence; there is no opportunity to attempt larger units or to bypass known information. It depends on an elicited response at each step. The branching technique usually presents the learner with a longer unit of materials followed by a multiple choice-type item. The response to the item determines which of several units he will be directed to work on next. Considerable argument exists about the relative merits of the two procedures; the relative advantages of each depend on the type of learning. Simple discrimination, perceptual learning, and sequential learning tasks of both verbal and motor types are probably better suited to a linear type program, whereas problem solving and various analytical tasks are better served by branching programs.

Television differs from the teaching machine in providing limited opportunity for interaction between teacher and learner or program and learner. It is essentially a lecture or demonstration type of presentation. The research available on films and television, by now quite extensive, indicates that both are as effective in informational and skill learning as conventional teaching methods. Both can induce changes of attitude and motivation, although the mass media in general are likely to play a role secondary to other social agencies in this respect except where a viewer lacks prior experience. One of the hurdles educational television faces is overcoming the habitual resort to TV as escapist, recreational fare in out-of-school viewing.

The concern and consequent reassurance about new teaching aids not replacing the teacher (which is usually offered as an afterthought to reassure teachers that they are irreplaceable) fails to view the change that these aids are imposing on teachers and curricula. For example, large numbers of elementary school classrooms are attempting to learn to speak French or Spanish by means of televised instruction.

There is no question but that schools, like industry, will adapt to automation, with a resulting reallocation of manpower and skills. The nature of children and learning being as they are, the probability is that few teachers will be displaced, but in any situation where the device can instruct as effectively at a lower unit of cost, it will be used. If the result is to provide greater learning with the same resources, a replacement of less competent teachers by those with a higher order skill, or a better provision for individual differences, we should utilize such equipment. Certainly our provision for individual differences has been most inadequate to date—our annual convoy type of education, and our ability to manage attitudinal, social, and conceptual learning is most uncertain and haphazard. The major task ahead is to learn how instructional devices can be most effectively incorporated into the educational process; to learn how to integrate the teacher, materials, programs, and learners; and most important, to extend our knowledge in areas of learning other than informational acquisition and motor-skill development.

Transfer of Training

Teachers exist to initiate or change behavior through the kinds of experiences they provide their charges, and education exists to provide an optimal social order. To relate the two requires that whatever is being learned in school should have some relevance to life outside of the school, and that the instructional procedures followed should demonstrate the connection and the possible application. Certainly the pursuit of knowledge is a vital and valuable activity of man, and valuable in its own right, but that all knowledge should be pursued in a vacuum is suicidal. The atomic scientists, as much as they might have preferred otherwise, felt obliged to take an active role in policymaking in political and social affairs. Teachers have a similar responsibility, at least to their students, to make the fruits of their teaching relevant to the lives of their students. This means that the primary objective is transfer of training of that being learned to that being lived.

One of the first generalizations offered in this monograph was "begin where the learner is"; not only where the student stands in terms of achievement tests, but in terms of life as well. If a teacher expects to produce some effect on the life of her students, she needs some knowledge of what that life is. Unfortunately, the life in the school and that outside are often completely separated. We pay little attention to the economic conditions, recreational activities, television programs watched, friendships, and the attitudes expressed in game and group. As a result we have no knowledge of the possible relationships between the learning experiences and lesson materials of the school and the lives of the learners.

Knowing that transfer is facilitated by the development and application of meaningful generalizations, we lose sight of the fact that meaning is more to be found in the day-to-day run of experience than in the logical explanation of textbook or teacher. This is especially true in the social sciences and humanities and in the grade school equivalents of these subjects. If the knowledge we have accumulated about attitude development and social behavior is to have any significance, it will be due to our use of it to reduce the social antagonisms and prejudices children absorb from their environments. If this cannot be effected in a school environment with the access and time it provides, it bodes ill for mankind.

Part of our reluctance to approach such matters stems from a desire to "let well-enough alone," knowing that many vital questions are hypersensitive ones. Students are aware of adult attitudes on family relationships, and questions which involve political, economic, religious, or social matters. Yet, under impartial tutelage, they could be brought to approach such questions with honesty and enthusiasm.

We define our educational objectives in terms of skills, knowledge, attitudes, and behavior. The schools are doing an effective job on the first two, but the latter are left much to chance. Our task is to relate all of these objectives to each other and to the whole, which in the smaller sphere is the life within the community of classroom and school, and in the greater sphere that of the community at large. In order to achieve this we must be aware of the life within these communities; relate the content and events of the classroom to the life experiences of the students; capitalize on day-to-day events to give meaning to instruction; and utilize knowledge of group processes to influence the development of desirable attitudes and behavior.

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